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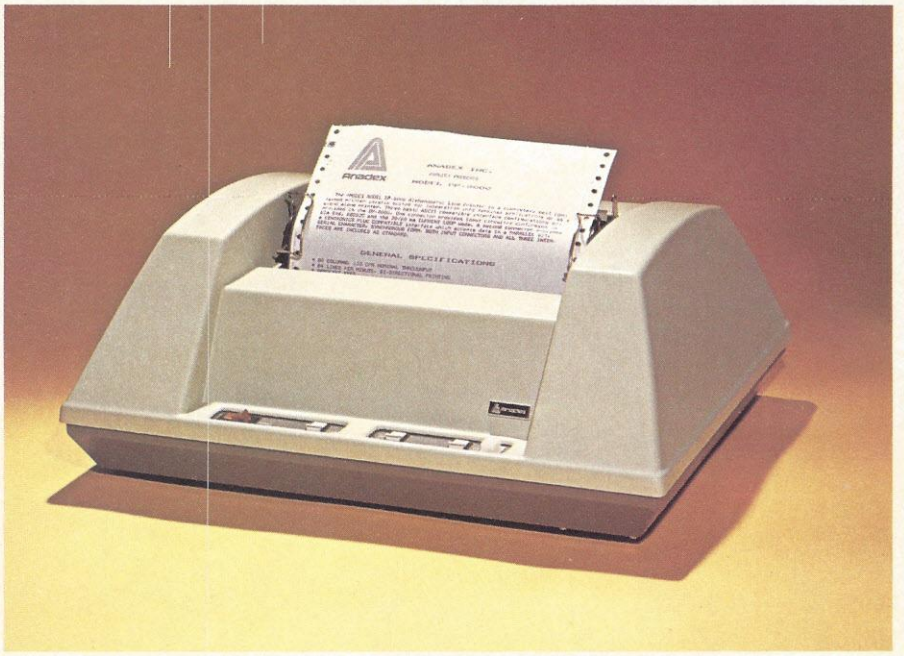

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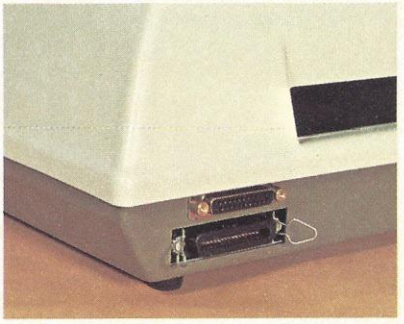

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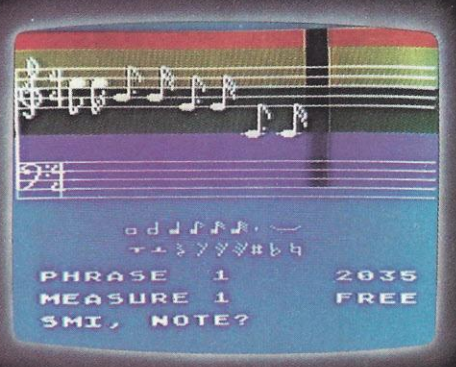

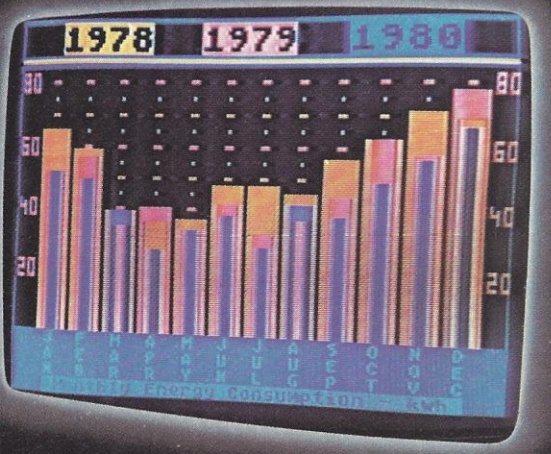

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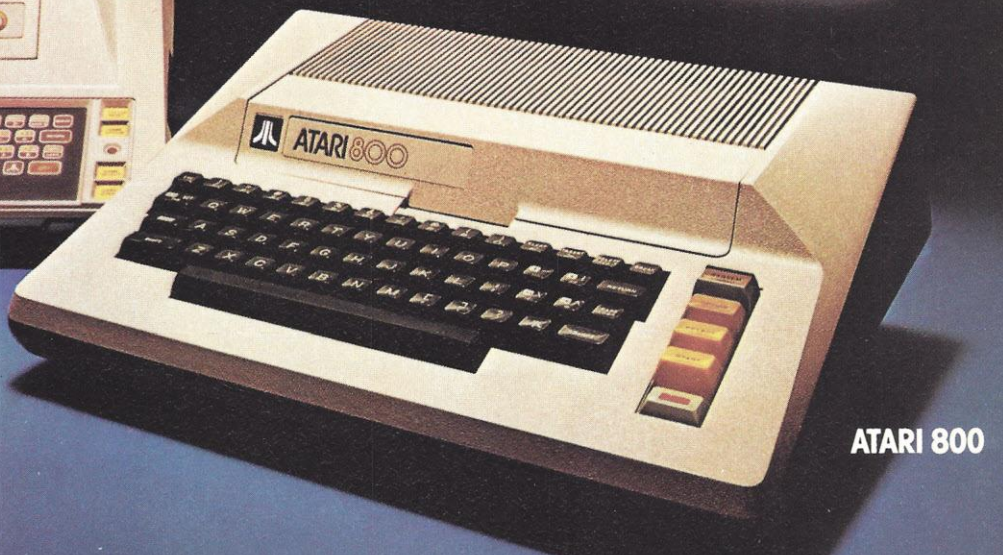

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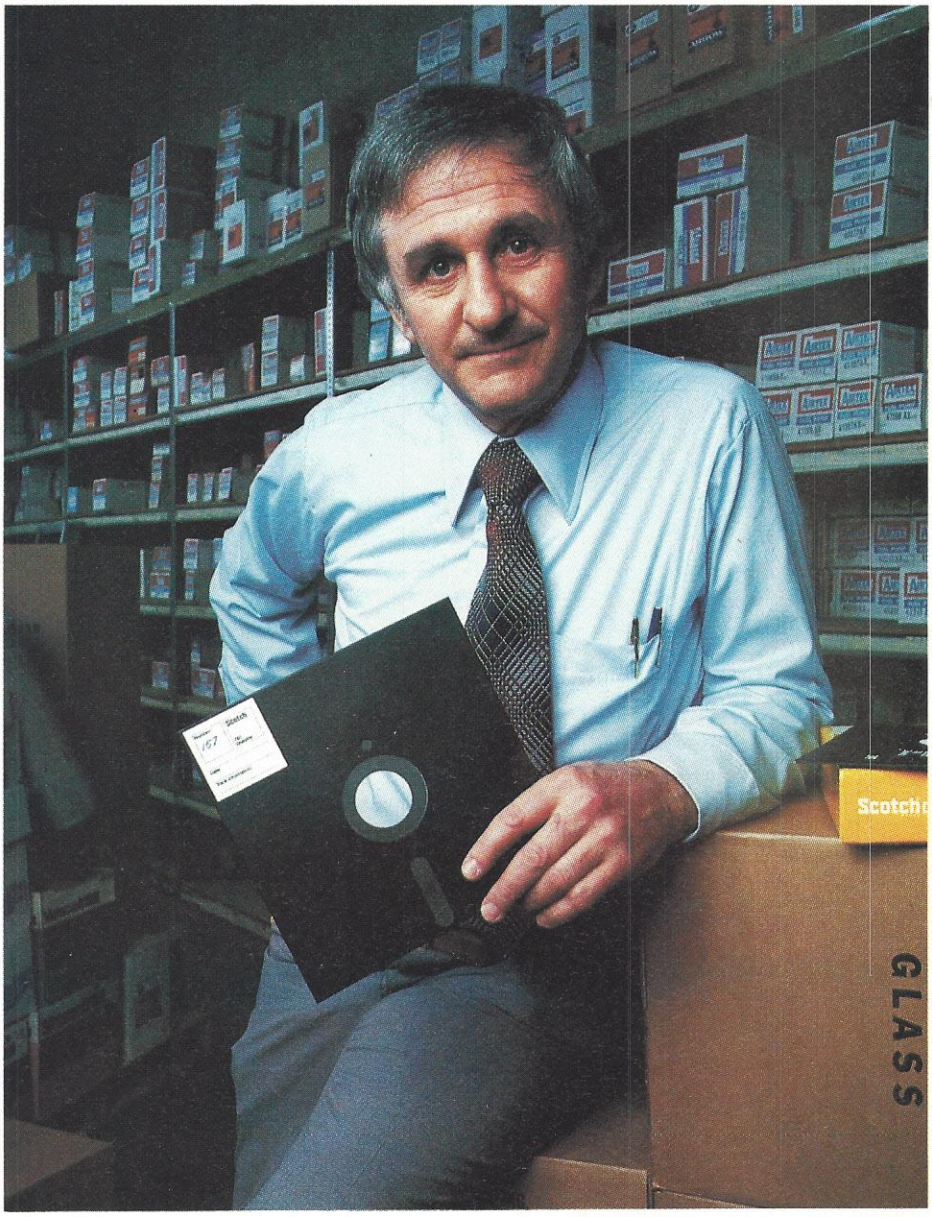

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CIRCLE 12

NOVEMBER 1979 VOL. III NO. 11

Personal Computing

For Your Home and Business

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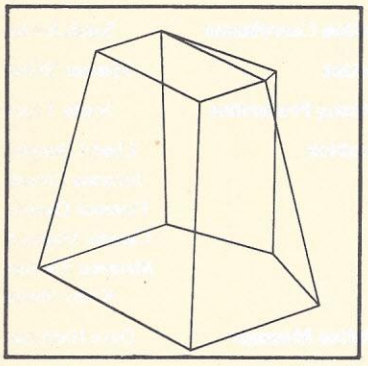

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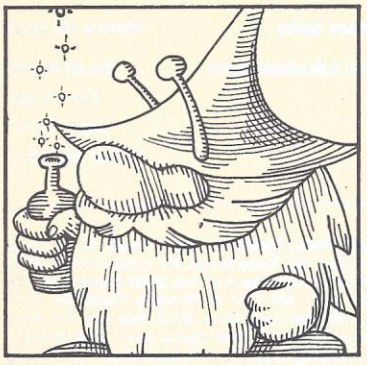

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DEPARTMENTS

COVER STORY

LAUNCHING PAD

DIGGING IN

IN THE MONEY

ON THE LIGHTER SIDE

Publication Number ISSN 0192-5490

Personal Computing

NOVEMBER 1979 Vol. III, No. 11

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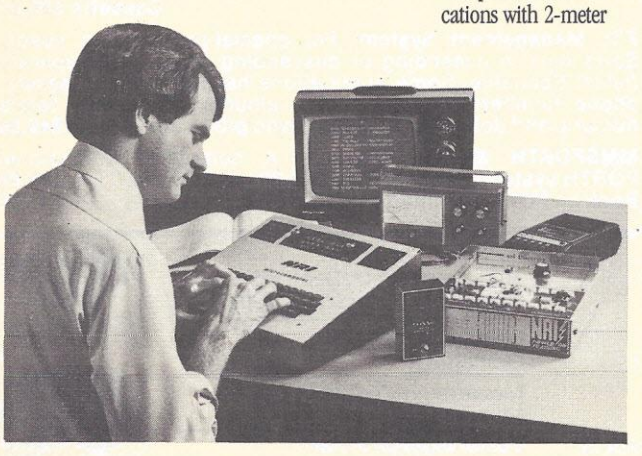

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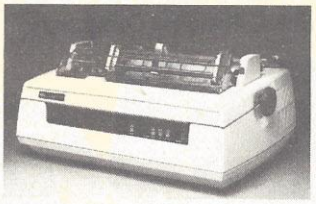

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CIRCLE 6

FEEDBACK

Formatting Numbers

Dear Mr. Roch:

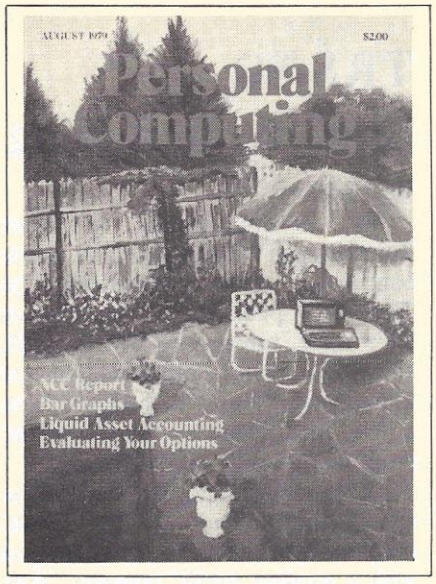
Much as I hate to criticize a fellow writer of computer programs (especially in the same issue), I must comment on your "Formatting Numbers in 8K BASIC" in the August issue.

In 35 lines of programming neglecting the REM statements, you have provided a method for using a Fortran-type formula to apply a PRINT USING command to a BASIC not having the latter. Excepting only that trailing zeros to the right of the decimal point are omitted — a small price to pay! — I have done the same thing in *one* statement.

See, for example, the statement numbered 0370 in "Liquid Asset Accounting System" on page 55 of the same August issue. This statement provides the alignment of the decimals in the left column of Figure 2 on page 54. Statement 0380 provides the decimal alignment for the right column in these same two figures. The position of the decimal points are determined by the values assigned to P2 and P3 in statement 0335. The general form of the formatting statement is:

XXXX PRINT TAB(P-(LEN(STR$(INT(A))))L;A

This statement will print a whole number with the (implied) decimal at position P, provided the length of the whole number (and sign if negative) does not exceed P-1. Some examples



are as follows:

BASIC Print	Decimal Align
123456	123456
4.327	4.327
29.6	29.6
0.007	7.0E-3

So long as one is dealing in dollars and cents, the only problem is the occasional loss of one or two trailing zeros, and the loss of the decimal point when two trailing zeros are omitted (whole dollars). As you can see from Figure 2 cited above, this omission is unlikely to cause problems.

I have never been sufficiently enamored of the Fortran method of fixing a print format to go to as much trouble as you have to emulate it.

Robert Irving
Northbridge, CA

```
>LIST
START   INPUT N
        A$=STR$(INT(N)):B$=STR$(N-INT(N)):
           B$=B$+"00"
        IF LEFT$(B$,1)="." THEN B$=LEFT$(B$,3)
           ELSE B$="."+LEFT$(B$,2)
        A$=A$+B$:PRINT A$:GOTO START


>RUN
?123
123.00
?123.4
123.40
?123.45
123.45
?1234.567
1234.56
```

Figure 1

Mr. Roch replies: I agree 100%. Your one liner will do what I took 35 lines to do — but you get what you pay for. If appearance is important then you pay the cost of the extra code. No way is 123456 or 4.327 acceptable on a nice looking financial sheet.

When I wrote the "Formatting Numbers in 8K Basic", I was running 8K MITS BASIC. I was writing formatted string records to cassette tape using a RO-CHE Multi-Cassette Controller, so I had to have the fields all the right length before concatenating them together.

I am now running Tarbell BASIC with a CP/M system. The earlier version of TBASIC did not have PRINT USING so I came up with a new and faster formatting scheme. See Figure 1. Add Mr. Irving's one line after my two lines and you have a three-line formatter.

This routine will work fine if you always want two decimal places; otherwise there is more overhead in making it variable. Also, the string number needs to be left padded with blanks to bring it to size if the fields are to be concatenated.

The real answer is PRINT USING.

Bill Roch
Woodland Hills, CA

A Note From Prison

Dear Editors:

The rules in the Colorado State Prison state that no pets are allowed on the grounds. Well, thank heaven that doesn't include PETs. I have been in prison for several years now and I have participated in the usual rehabilitation programs that most cons encounter. Three months ago I began working in the Electronics Maintenance Shop here and encountered my first micro, an 8K PET. That micro has probably had a greater rehabilitative effect on me than any other thing that has happened to me since my arrest.

In behalf of the other men in the shop and myself, I would like to ask your readers if they would help us with our pursuits. Our efforts in learning programming and maintenance of our

micros are mostly on our own, with the help of our supervisor as far as his knowledge and budget permit. Would any of your readers be willing to send us such things as back issues of micro magazines, programs, 650X programming manuals, software for PET, and so forth? Basically, those things that tend to accumulate on shelves and benches that are no longer used. Almost anyone else's extras and clutter will be our goldmine.

Also we'd appreciate correspondence from other micro users.

Finally, I'd like to give a public "thank you" to Mr. Ed Wood, our shop supervisor, for his support and help. You at *Personal Computing* keep up the good work. I think your magazine is the best of the bunch.

Ronald L. Schuemann
42126
P.O. Box 999
Canon City, CO 81212

Random Patterns

Dear Sir:

If you like random patterns, try this program on a TRS-80. Obviously the numbers can be changed and the program can be altered for more interesting results. Try various entries.

```
 1  RANDOM: DEFINTB,N,I,R,P
 2  CLS:?:?
 4  INPUT "ENTER A LARGE NUM-
    BER";N:?:INPUT "ENTER A
    SMALL NUMBER";B
 5  CLS:FORI=1TON
10  P=RND(63)+128
20  R=RND(1022)
30  ?@R,CHR$(P);:IFR/B=INT(R/
    B)THENIFR>3?@R-3, "2Δ";
35  NEXT
40  GOTO5
```

This will go on all night. If you like less clutter, change line 30 to:

```
?@R-3, "5Δ";
```

If you would like to fill the screen, leave out the end of line 30.

Franklyn D. Miller
Cincinnati, OH

Editor's note: In the listing above, the "2Δ" means put two spaces between the quotes. Likewise, "5Δ" means five spaces between the quotes. A very handy notation! —*D.W.*

TRS-80 Line Renumbering

Dear Editor:

My congratulations to Mark Zimmermann on the excellent article concerning "Line Renumbering On The Pet", published in your March 1979 issue. I have a TRS-80 Level II, and the format for storing program text in memory is similar to the Pet's. With a few modifications, Mark's BASIC program runs well on the TRS-80.

As Mark mentioned in his article, the most glaring fault of his BASIC program is that it could not be merged with a residing BASIC program. With the information presented in the July issue of Radio Shack's newsletter, merging two basic programs is now possible.

To merge the Renumber program with the program to be renumbered, three conditions must be met. The program to be renumbered must have line numbers less than 63000, no more than 128 lines (for 4K memory), and it must reside in memory. A sample merge would look like this:

1. Print PEEK (16633), PEEK (16634)
2. If the content of PEEK (16633) is 2 or greater, execute: POKE 16548, PEEK (16633)-2: POKE 16549, PEEK (16634)
3. If the content of PEEK (16633) is 1 or 0, execute: POKE 16548, PEEK (16633)+254: POKE 16549, PEEK (16634)-1
4. Load the Renumber Program using the CLOAD command.
5. After the program is loaded, execute: POKE 16548,233: POKE 16549,66
6. Enter RUN 63000. The Renumber program will tell you when all line numbers have been renumbered. To delete the Renumber program enter: DELETE 63000-63900.

Theodore A. Cannell
Lansing, MI

Editor's note: Mr. Cannell recommends the following changes to allow Mark Zimmermann's program to run on the TRS-80: In line 63010, change DIM OL (255) to DIM OL (128); change AL = 1 to AL = 233; change AH = 4 to AH = 66. In line 63510, change L = 1024 to L = 17128. In line 63540, change CH < > 137 to CH > 202; change CH < > 145. —*D.W.*

Resetting the Record Straight

Dear Editors:

I want to make a few comments about your August issue.

First, the "Formatting Numbers" program on page 24 is the kind of article that I subscribe to magazines for. More, please. The "Jump Hole Gunner" program on page 58 is interesting and very frustrating to play. It would be a bit better if it had different run speeds (skill levels).

The "NCC Report" on page 34 started out OK, but y'all blew it! The Reset key on the Apple computer does not — repeat, not — destroy the program that is in memory. Control C will recover everything. 3D0G will recover program and the DOS if it has been booted. Control C plus CALL 976 will also recover program and DOS.

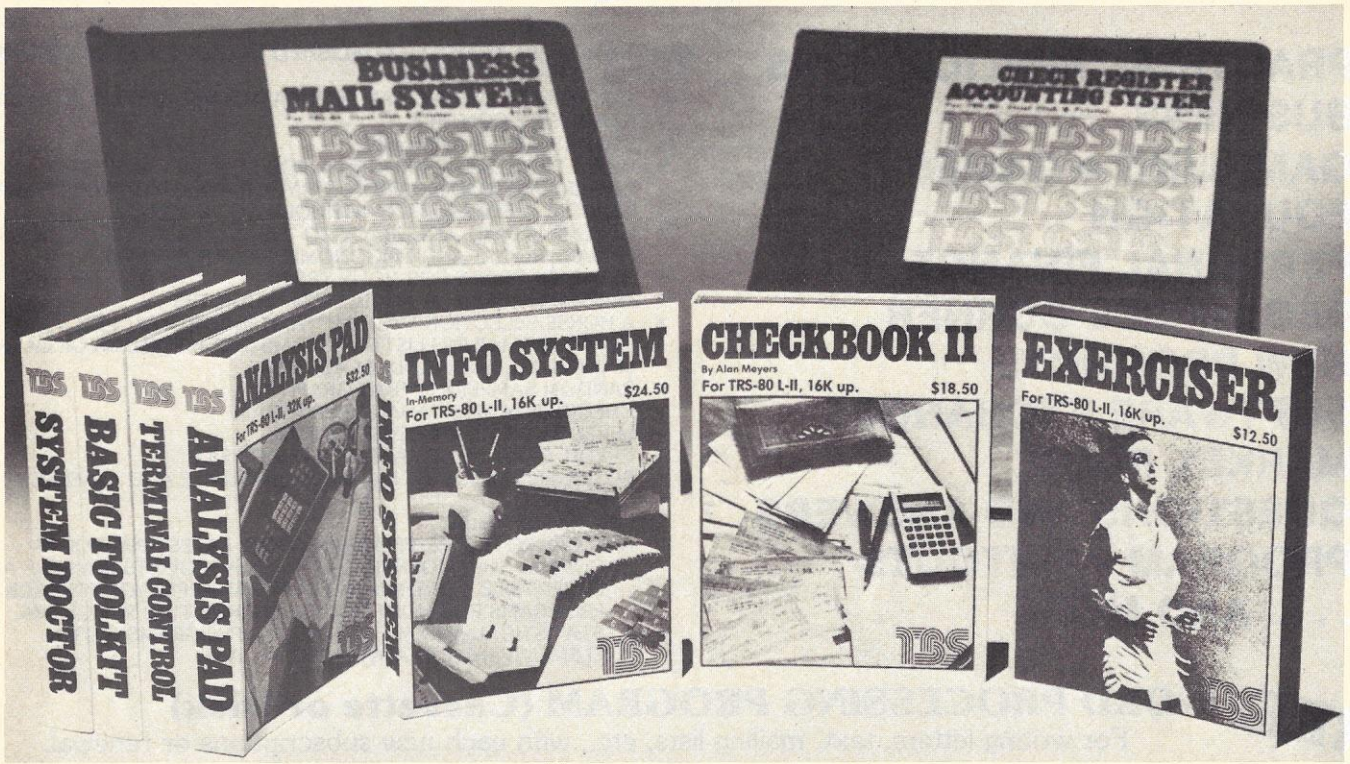
Errors of this type are bad for both the computer company and the magazine. When I find things like this, I do not believe any of the rest of the article. How about a little more homework?

John W. Davison
Ft. Walton Beach, FL

Editor's note: Mr. Davison is quite correct, both about the Reset key and about the possible effects of such errors. Unfortunately, errors occasionally creep into the magazine, not only in text but in program listings. If you spot an error, please write to let us know. We'll correct it immediately.

On the original Apple II computer, the Reset key jumps you to the machine's Monitor program; however, you can easily jump back to BASIC without destroying whatever program you're running. In the Apple II Plus, pressing Reset halts program execution but leaves you in BASIC. You can continue running your program with CONT, or start it again with RUN. —*D.W.*

THE BEST.



If you're not content with just playing games, **TBS** is producing applications software for your TRS-80 Level II that makes it a practical tool.

CHECKBOOK II by Alan Meyers is the finest program of its kind yet published. With superb graphic screen displays, it does everything necessary to keep your checkbook balanced. Data is input directly into a five-column screen display with a field for alpha or numeric codes. Editing is done easily in any or all columns. **CHECKBOOK II** will accurately balance and reconcile your checkbook, handling balances up to $1,000,000. Your balance brought forward is always in memory. Outstanding checks are listed and easily saved. You can also search for an entry by any field except amount, and all checks with matching entries will be displayed and totaled. A numeric sort routine is included. Screen prints can be made to a line printer from almost any point in the program. In addition, the 32-48K version can write files to disk. This and the 16K version are included on the same tape. For $18.50, **CHECKBOOK II** is the top of the line in personal checkbook programs.

INFORMATION SYSTEM by Dale Kubler is simply the best in-memory, data base manager on the market. It allows you to create files with up to ten categories per 'page', up to 40 characters per category and 200 characters total per page. Data from the keyboard is entered directly on a screen display of one entire page. Once entered, you can sort or search your entire data base by any category and have the information desired displayed on the screen. **INFORMATION SYSTEM** provides a thorough editing mode allowing changes by line without rewriting an entire file. Program your own printouts to almost any form you desire for line or serial printers. Screen prints from anywhere in the program are also available. **INFORMATION SYSTEM** creates either disk or cassette files depending on the version you use. Four versions are supplied with the program tape. From mail lists to recipes, for only $24.50, this program is the ideal information manager.

EXERCISER is for everyone. This program allows you to set your own physical fitness goals, then chart and analyze your progress toward these goals. Further, you may program an exercise regimen, then have the computer 'coach' you through your exercise routines. This system will allow you to use your computer to reinforce your effort to attain physical health. **EXERCISER** is really two programs in one. One measures your progress in jogging, swimming and bicycling and the other is for setting calisthenic regimens. It has long been known that to effectively structure an exercise program, it is necessary to think in terms of goals which can be met over a period of time. Whether you are training for the Boston Marathon or just wish for a minimum level of fitness, **EXERCISER** is designed to help you attain your goals. The price for this exceptional program is just $12.50.

TBS has other great software for your TRS-80. **BASIC TOOLKIT, SYSTEM DOCTOR & TERMINAL CONTROL** are systems utilities. **BUSINESS MAIL LIST, DATA BASE MANAGER, CHECK REGISTER ACCOUNTING SYSTEM & ANALYSIS PAD** are strong applications for business. Don't forget the **LIBRARY 100**; 100 programs for only $49.50. **TBS** also has **DISK HEAD CLEANERS** for **TRS-80** and **APPLE** and **GRAN MASTER DISKETTES**, the best on the market.

TBS is **YOUR COMPANY**, and to you we pledge to produce quality software at a price you can afford. The above products are available **NOW** at Computer Stores and Associate Radio Shack Stores nationwide or directly through us. For more information please contact us at the numbers below.

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CIRCLE 7

RANDOM ACCESS

Freeing Trapped Intelligence

Michael, 17, was working on a computer, but had not yet learned to store his programs. Accidently he made an error which erased his programs, destroying many hours of work. Undeterred, he typed the programs back into the computer from memory.

Such a feat is remarkable for anyone, but consider that Michael, who has cerebral palsy, has only garbled speech and is physically unable to write. Until he began working with a computer, less than a year ago, Michael's intellectual abilities could only be guessed at. Now, while working on LOGO, a computer-based learning system developed in the Artificial Intelligence Laboratory and the Division for Study and Research in Education at MIT, Michael has proven that he is indeed bright and eager to learn.

The focus of his work has been not only on using LOGO as a new way to teach the physically handicapped, but also as an aid to study how people — particularly handicapped people — learn.

LOGO, an easy to use, flexible system, allows the user to write, edit, draw or even compose music. Most important is that the computer acts as an extension of the person working on it, not as a "super-teacher" which dictates what the student learns.

Using a computer system such as LOGO gives the researchers an excellent opportunity to study how people learn. For research purposes all input information is recorded; errors as well as innovations are saved for analysis.

"LOGO can be used by normal children, adults or anyone," said Dr. Sylvia Weir, a physician with training in artificial intelligence who is a research associate in SDRE, "but most recently our work has been with handicapped people."

For the past year the researchers have been working with children at Cotting School in Boston, the nation's oldest school for handicapped children, as well as with normal children, for comparison purposes. The research is funded by Bureau of Education of the Handicapped of the U.S. Department of Health, Education and Welfare.

"As a teaching tool LOGO has been extremely successful even with the severely physically handicapped," said Dr. Weir. "One boy, who had never been interested in doing anything, sat down in front of the terminal and wouldn't get up for 12 hours. A girl who could barely write began to make up stories. A third boy was so enthusiastic he spent a whole week typing a long and elaborate letter to his parents about his work with the computer.

"For many of the children this is the first time they have been motivated to really enjoy learning. One of the big advantages of this system is that for expending relatively little effort, pressing a few buttons on the keyboard, there is tremendous return. For the first time many of the children, momentarily at least, overcome the problems of their handicaps."

Michael, a pupil at Cotting School, is Dr. Weir's star student. While some of Michael's teachers thought he was very bright, they had no way of knowing since cerebral palsy kept him from communicating his thoughts.

Introduced to the computer about nine months ago, Michael has devised dozens of his own programs. He likes to spend hours perfecting his work or delving into new areas, and he even teaches a computer class at Cotting School. Michael plans to select a career where he can use his computer talents.

"Michael is an excellent example of trapped intelligence," said Dr. Weir. "If a person is handicapped to the extent that he can't express himself, then how do you know what's in that person's brain? That is what we're trying to do — use LOGO as a communication bridge for people who can't express themselves any other way."

Dr. Weir and her colleagues, including graduate student Jose Valente, are also using LOGO as a research tool for their work with handicapped children. Besides looking at the general question, "How do people learn?", the researchers are looking to see if handicapped people learn differently, and if so, is that learning experience different in some cases due to damaged brain tissue or due to damaged experience because of the handicap itself?

There are no answers for these questions yet, but work is still continuing. One long-standing problem has been the lack of a good way to measure the abilities trapped within a handicapped person's head. Standard intelligence tests assume a high level of manual dexterity, a standard kind of life experience, and include time pressures that make it difficult, if not impossible, to accurately test people with severe physical handicaps with standard intelligence tests.

"I dislike even the term 'I.Q.' because it assumes, inaccurately I believe, that it is possible to simply describe an individual's overall intelligence," said Dr. Weir. "Even normal people have wide variations in their ability from one subject area to the next and these variations are often magnified in the handicapped."

One of the goals of the LOGO project, under the direction of Dr. Seymour Papert, professor of mathematics and Cecil and Ida Green Professor of Education at MIT, is to develop tests which will measure the abilities of han-

dicapped people in various areas.

For example, one common test for normal children is to have them feel blocks of different shapes and say what shapes the blocks are. Obviously this would not be a good test for someone without hands, or even for someone who has so little control over his hands that he cannot systematically feel.

The LOGO group has, however, adapted the block feeling test for the computer — a pseudo-palpation test. In this test the student moves a cursor until it changes shape, indicating the boundary of the "block." Pressing a button then gives the student a small piece of the block which disappears before the student moves the cursor for the next piece of the block. After seeing a few pieces of the figure the student should be able to successfully reconstruct the hidden figure and pick out which of a number of possible blocks it corresponds to.

By using a number of specially devised tests such as this one, the researchers should be able to analyze the abilities of handicapped students in a number of areas.

"Computers are quickly filtering into the mainstream of society and before long they will not be uncommon in schools," said Dr. Weir. "We are trying to do work so that these computers will be used in the most profitable ways possible."

— Karen Ray

Television-like IBM computer terminals, located in two Harrah's casinos in Reno and Lake Tahoe, help customers avoid long waits for checks to clear. Twin computers maintain the current status of each customer, after the customer and Harrah's agree on a credit or check-cashing limit per week. There is one terminal in each "pit," or set of blackjack, baccarat and roulette tables on the casino floor. As a customer moves from one set of games to another, or even from one casino to the other, pit supervisors can enter his name into a terminal, along with a physical description if several patrons have the same name, and receive up-to-the-minute reports on his credit or check-cashing status.

Computer Controlled Homes

New homeowners can turn their houses into computers by installing a programmable electrical system that will control lights, appliances, security systems, lawn sprinkers — virtually everything controlled by electricity.

Harris Labs of Marshalltown, IA, developed this Home Control System which can manage up to 256 circuits with its Texas Instruments TMS9900 16-bit microprocessor.

The system replaces light switches with one-inch-square sensors that operate lights and electrical outlets at the touch of a finger. A pair of wires connects the sensor directly to the computer, allowing a brief touch of a finger to activate an electronic switch responsible for turning the correct light circuit on or off. Each small square features a mirror-bright finish on the sensing pattern and mounts directly on a wall without an electrical box. Consequently, the square can be placed where usual light switches could not because of size and wiring.

A master panel shows which of the controlled circuits are on with small, red light-emitting diode indicators. Operation of any circuit from a single location is permitted with a matrix of touch sensors.

Lights and appliances may be turned on and off automatically based on the time of day,

day of the week or calendar date. By entering simple commands through the systems command unit, you can instruct the computer to turn on the coffeemaker, bedroom lights and radio in the morning, and turn off the electric blanket. You could schedule these events for 6:30 a.m. Monday through Friday, not at all on Saturday and at 9:15 on Sunday —or at whatever times fit your needs. Any controlled circuit can be programmed on its own schedule.

Other possibilities for automation include plant and aquarium lights, stereos, lawn sprinkler systems and porch lights.

The Home Control System's computer can be installed inside a wall between studs, with room to spare. Twenty years ago a similar computer would have consumed more electricity than the average family; this one uses just a few watts, according to Harris Labs.

"The Home Control System is patterned after the computer systems used for industrial process control," explained Laurence Harris, president of the company. "We have adapted that technology to meet the needs of homeowners by using a TMS9900 16-bit microprocessor system instead of a minicomputer, and packaging the system suitably for use in home. Although the cost is more than most people will want to spend initially, from just under $3000 to well over $6000 depending on the size of the system, prices should come down as production volume increases."

Presently, three homes function with the Home Control System, all in the central Iowa area, said Harris. Five more homes are in the process of having systems installed.

For more information contact Laurence Harris, Harris Labs Inc., 1106 Westwood Drive, Marshalltown, IA 50158; (515) 753-8529.

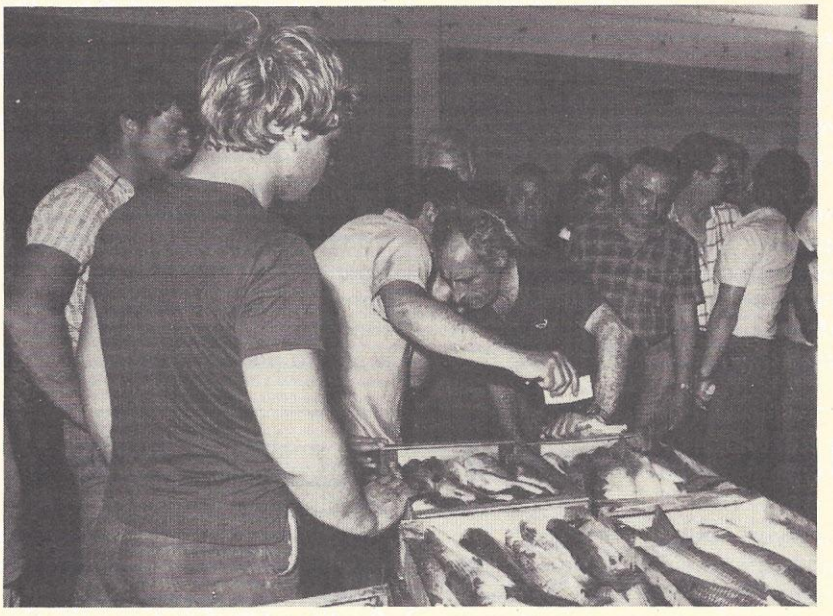
A Fish Story

Chioggia, a town in the ancient Venetian region on the shores of the Adriatic Sea, has a municipal wholesale fish market. There, fiercely competitive dealers whisper their auction bids for the day's catch to sharp-eared auctioneers and the fishermen collect their money on the spot on the strength of a computer printout of the winning bid.

More than 2000 fishermen, working a fleet of about a hundred deep-sea fishing boats and a larger fleet of smaller boats, bring in 17,000 tons of fish annually — about 300 varieties — to be sold to 250 registered dealers.

Apparently, the whispering auction is an old tradition in Chioggia. Dealers whisper their bids for each lot to one of 14 municipal auctioneers, who assigns the lot to the dealer who made the best offer. The auctioneer then fills out an "auction sheet" which allows the fisherman to collect his payment from the Cassa di Risparmio di Venezi bank, which maintains a branch at the fish market.

Filling out the auction sheet requires calculation of a lot of data by the auctioneer. Since the sheets have to be completed on the spot, the opportunities for errors are as abundant as the fish in the Adriatic. Consequently,



the Chioggia fishing industry sought the aid of a computer.

Since the Chioggia town council already had a Honeywell Level 62 performing administrative tasks, they decided to put the wholesale fish business on the computer as well.

Now pertinent information is entered into the computer through one of the five on-line Honeywell visual display terminals the council installed at the market. The data includes the auctioneer's identification code, the species or type of fish sold, the quantity, price per kilogram, lot weight, name of buyer, the seller and so forth.

The computer performs a series of validations, translates all codes and computes the total value of the lot, commissions, taxes and other charges and values. The auction sheet is printed out on one of two on-line Honeywell printers located next to the visual display terminals. A copy is given to the fisherman to be cashed at the bank.

At the end of each trading day, the computer prints out invoices to the dealers, along with other reports and sales statistics for the town council. Additional summary computer reports and statistics are produced on a monthly and annual basis.

Jim and Kay Weir Reinvent the Wheel

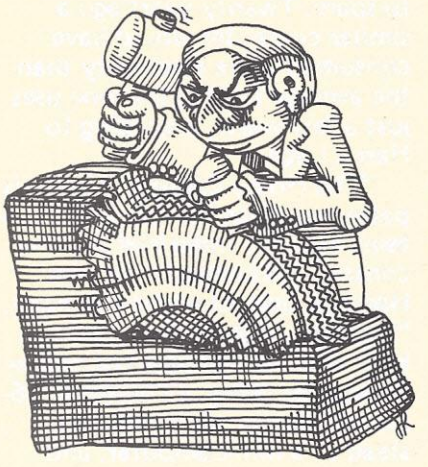
A bilingual Apple II has taken a giant step towards reinventing the wheel — or at least its first cousin, better known as the tire.

Retreading tires has traditionally been at best an imprecise procedure, relying on a trained eye to match a used tire to a proper size mold. That's changed, thanks to Jim and Kay Weir and their Matrix Selektor — a machine which utilizes an Apple II to make the perfect match.

The result is a better, safer tire with a longer tread life.

"With the help of the Apple," Kay said, "we're making retreading the precision operation it has to be to succeed." The Matrix Selektor may also have applications for new tire manufacturers, but for now the Weirs are busy working with retreaders eager to try out their revolutionary device.

The easy-to-use Selektor communicates in either English or Spanish. An operator mounts the used tire on the machine, which then measures its size, and identifies which mold in the shop (if any) should be used for the re-



treading. The Apple II then monitors the buffing, and shows the operator when the tire has been buffed down to acceptable parameters.

Their machine was conceived in 1977 during an informal gathering at the National Tire Dealers and Retreaders Association, which eventually helped finance the research and development costs. Kay explained that other attempts had been made to perfect this mold matching and buffing process, but none succeeded until the computer was applied.

Jim and Kay have been in the tire business for over 30 years, but stopped working fulltime in 1969 to do only occasional consulting work. Their invention has now ended that retirement in a big way, as they strain to keep up with the demand for their new product. So far they have manufactured and installed four systems. Their company, Tire Devices in Culver City, CA, "is inundated with calls and letters from around the world."

Developing the Matrix Selektor was the Weir's first introduction to computer technology. Though they received programming help from Bob Bishop of Apple Computer, they also spent endless hours matching wits with each other and the Apple II in a variety of computer games. It was, they felt, the only way to really get to know their new business partner.

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Legal Computing

Lawyers spend enormous amounts of time doing research — tracking down laws, precedents, court decisions and opinions relating to the cases they're working on. But with the advent of the computer, methods of doing legal research are changing. And within five years, computers will change the nature of legal services delivered to the public.

The problem faced by all lawyers boils down to this. You have to get the latest decisions regarding the situation presented by your client. Big law firms hire people who can spend time running down the cases concerning the situation, digesting what the court said, and then making recommendations as to how to proceed.

A small independent lawyer has to do this research himself. If the situation involves Zoning, then he has to find the cases relevant to what his client asked him to do. If the situation involves Creditors' Rights, he has to look up the decisions relative to the situation. But alas, the research isn't quite so simple. The lawyer also needs to check the various statutes that pertain to the situation.

And the legal field has specialists who are well known as experts in Maritime Law, Bankruptcy, Criminal Law and so forth. The ordinary practitioner may consult these specialists when he faces a situation requiring their expertise, but he is not the expert. However, using a computer can turn him into that expert.

Suppose a man is arrested and the lawyer receives a call from the father to defend his son. The police searched the son's apartment and, on a table, found a revolver for which the son had no permit. Into the computer goes the cassette tape marked "Search and Seizure." The code name for the situation is "Plain View Doctrine." So the lawyer gets all of his data from his first tape and then uses the second.

But is the information up-to-date? Plugging into his data bank gives him the latest findings regarding the situation, including a digest of important cases. Pertinent statutes are also presented on the screen.

One case seems very important. So the lawyer asks to see this case on his screen. He reads it carefully for half an hour. Then he pushes a button and out comes a hard copy of the case, with important points underlined for his attention.

If one lawyer can do all this,

then it follows that the entire court system can be tied in to computers. In my city, we have what can best be called "Housing Part Judges." Pity the poor judge — in the past, he had one big headache. He needed information concerning the maintenance, tax and fiscal history of buildings in litigation.

So the judge's law clerks spent hours of valuable time rounding up the needed information. But now the computer has come to the rescue. The judge can use a video display terminal to obtain data on uncorrected violations, ownership and management registration, real estate tax arrears, complaints and emergency repairs on any of over 136,000 multiple dwellings in the city.

This system is tied to the records of the Division of Code Enforcement of the Department of Rent and Housing Maintenance, which formed the data bank for this computer setup.

Computers can be used by judges sitting in other branches of the court system, too — for example, in the Criminal Division. Consider a case that goes to an appeal court. The five judges in this court all look at the video screen which presents the latest rulings regarding that specific case.

Upon the same law and set of facts, different minds will come to different conclusions. Computerized law will not create unanimous rulings. In no way will computers make the jury system obsolete. After the judge charges the jury as to the law in the given situation, they begin their session behind closed doors. They have to decide upon the facts presented, whether those facts are in accordance with the law or not. They must decide Guilty or Not Guilty in a criminal trial; or, in a Civil Trial, for the plaintiff or for the defendant.

Before making his charge to the jury, the judge can retire briefly to his chambers. With the computer at his service, he can make certain that he gives the correct charge as to the law in the case. He doesn't want a higher court to reverse his decision because of a faulty charge, so the computer becomes his best friend in this matter.

And the D.A. can use a computer in his office. To bring the accused before the Grand Jury for an indictment or not? The computer tells the D.A. that the police officer said he had a hunch. Acting on that hunch, he stopped the car, searched it and found narcotics. The decisions inform the D.A. that he has no case, so he won't waste the Grand Jury's time.

— Dr. Harold Gluck

The author edits a legal bulletin and writes legal columns for a number of trade and professional publications.

Touch-Screen Computers

A bountiful bookstore can be an intimidating place, especially if you're not sure which books contain the information you need. Thousands of volumes rising from floor displays, or smothering the walls in tightly packed rows, confuse an already bewildered mind. If only you could snap your fingers and have your questions answered!

The B. Dalton Bookseller store in New York City has solved this problem for its customers with the installation of a touch-screen terminal from Information Dialogues, Inc.

Known as the TST-180 (or informally as Book Rogers), this computer operates without a keyboard or printer. Instead, all the users have to do is touch the screen with their finger.

The key to the TST-180 is its 15-inch, television-like screen that immediately displays requested information when touched — for example, recommended books, prices, descriptions and answers to trivia questions.

Currently, B. Dalton's computer is programmed to tell customers about new book arrivals, special orders, mail service, gift wrapping, special binding, charge cards and points of interest in the store.

Book Rogers begins its "conversation" in a friendly manner. An approaching customer sees a message on the screen: "Hello. I'm here to help. Touch me and begin." After being touched, the computer displays a variety of categories on the screen, along with a new message, such as. "Touch area of interest." From there, the user is introduced to the available information.

The TST-180 is popular not only in the B. Dalton bookstore, but in other types of retail stores. In some cases, terminals are equipped with telephones customers can use to order merchandise from store departments.

Information Dialogues, Inc., is located at 7850 Metro Parkway, Suite 205, Bloomington, MN 55420; (612) 853-9200.

Computers Reveal Facts About the Nation's Past

The United States in the 1800s was not a nation of people driven to constantly move their homesites, as has often been popularly believed.

Between 1820 and 1880, more than 25,000 Dutch men, women and children secretly left Holland for a new life in America.

Those two facts, discovered by computers, are among reams of new information made public at a recent conference at Dartmouth College's Murdough Center titled "Data Bases in the Humanities and Social Sciences." More than 180 computer experts from 11 countries participated in the meetings.

The notion that the United States in the 1800s was a nation of people constantly moving toward the frontiers has been dispelled, according to Robert P. Swierenga of Kent State University. Mr. Swierenga is undertaking computerized research of U.S. "kinfolk" from their arrivals in America to the early 1900s.

He finds that immigrants generally preferred to settle down in family units and moved only with reluctance. And then, it was the women who got families going.

Analysis of a family of Europeans who landed in Boston, moved to Vermont, then to Michigan, and then partly westward, showed that while 70 percent of married male descendants stayed at home with the family, about half the female descendants married and left the family's home territory.

The secret movement of at least 25,000 Dutch across the Atlantic during a 40-year period in the 19th century was discovered with a computer's help by Robert Taylor of the Indiana Historical Commission. His comparison of Dutch government statistics on immigrants with U.S. ship passage lists showed that more than 25,000 Dutch residents arrived in America from 1820 to 1880 than had been before known. The immigrants, who tended to be young married couples, were slipping quietly away from Holland.

☆☆Announcements☆☆

"Science and Math Education Through the New Information Technologies" will be held in Tarrytown, NY, on November 8 and 9. This conference, sponsored by Wicat, Inc. under a grant from the National Science Foundation, will disseminate information about microcomputer, videodisk, and videotape technologies to science and math educators, government and industry officials, school board members, and science writers in the New York area.

The program will include speakers, seminars and demonstrations.

For more information contact Wicat, Inc., Room 29E, 111 East 85th St., New York, NY 10028; (212) 876-1144.

There's a new club in Vancouver. The Apples British Columbia Computer Society meets the first Wednesday of each month. Dues are $15 per year. Contact the president, Gary B. Little, at Apples British Columbia Computer Society, #101-2044 West Third Ave., Vancouver, British Columbia, Canada V6J 1L5; (604) 731-7886.

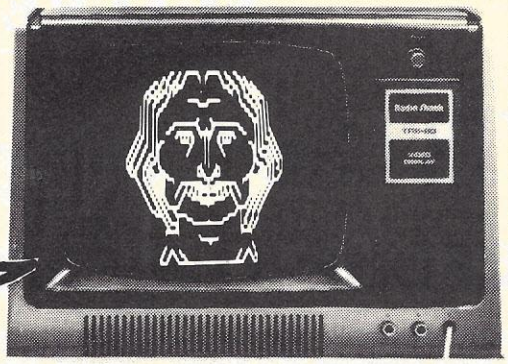
Apple II users in Washington, DC, and surrounding Maryland and Virginia communities have formed Washington Apple Pi to share expertise, software and technical information. The club meets at George Washington University, Room 206, Tompkins Hall, 23rd & H Streets, Washington, at 9:30 a.m. on the fourth Saturday of each month. A monthly newsletter is also published. For more information, write Washington Apple Pi, PO Box 34511, Washington, DC 20034; or call Sandy Greenfarb, (301) 674-5982.

The Crescent City Computer Club in New Orleans features Apple, Pet and TRS-80 user groups, plus hardware and homebrew groups. Write to Crescent City Computer Club, PO Box 1007, University of New Orleans, New Orleans, LA 70122.

The Micro and Personal Computer Club of St. Louis publishes a St. Louis Apple User Group Newsletter. Contact the club at 3268 Watson Road, St. Louis, MO 63139; (314) 645-4431.

TRS-80 owners LOOK

at these Programs!!! (and these prices!!)



Graphic Drawing Done On The TRS80 Using "The Electric Artist" Program!

GRAPHIC-TREK "2000" This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprize to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players!

INVASION WORG Time: 2099 Place: Earth's Solar System Mission: As general of earths forces, your job is to stop the Worg invasion and destroy their outposts on mars, venus, saturn, neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Nuetrino Blasters! Worg Forces: Robots — Saucers — Disintegraters — Proton Destroyers! Multi level game lets you advance to more complicated game as you get better!

STAR WARS Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb then escape via the only escape route. This graphics game is really fun! May the force be with you!

SPACE TARGET Shoot at enemy ships with your lazer gun. If they eject in a lifeboat vehicle, capture them, or if your cruel, destroy them! Full graphics, real time game!

SAUCERS This fast action graphics game, has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out! The saucers fight back!

Package One — $12.95

CHECKERS 2.1 Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. Computer also makes sly remarks about the game!

POKER FACE The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match!

PSYCHIC Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for party's.

TANGLE MANIA Try and force your opponent into an immobile position. But watch out, their doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!)

WORD SCRAMBLE This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles word then keeps track of wrong guesses. Can you make less mistakes then your adversary?

Package Two — $12.95

POETRY This exciting and sometimes funny program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then mood, and he does the rest! TRS-80 will write different poetry about one subject forever if you let him. Has a 1000 word + vocabulary of nouns, verbs, adjectives, adverbs!

ELECTRIC ARTIST Written by a working artist and a computer engineer to make drawing on the video screen easier then picking up a pencil! (Less messy too!) Manual: Draw, erase, move as well as, Auto: Draw, erase, move. Uses graphics bit's not bytes. Graphic face in ad done using this ingenius program!

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CIRCLE 9

Will the Computer Rescue the Brain?

BY WILLIAM R. PARKS

The growing inevitable mass acceptance of home computers as a household appliance in America is going to have an impact on our culture and daily life unparalleled in the history of our nation! Such a sweeping generalized statement needs some proof to convince educators, sociologists, politicians, other professionals, and even the general public. By the end of this article the reader will hopefully be inclined to agree that a very significant change in our society is coming due to the onset and development of home computing.

Let's start at the most elementary level of change — the individual user of home computers. What effect is taking place? Add up the total number of persons that will soon be using home computers and you will realize that the beginnings of a true revolution is now in progress. This revolution far exceeds the effect of the television revolution for several reasons. First of all, we certainly must agree that television is the most watched medium for news and entertainment. And the average person spends up to about 6 hours per day watching video programs!

Introduction of television in the last 30 years certainly has had a drastic — even revolutionary — effect on culture and life in America. Home computers promise to have an even greater and more dramatic effect. How is this possible? What, after all, could be more engrossing than television? What medium could possibly compete with television?

Before answering these questions, consider some recent findings from research laboratories. Did you know, for example, that a person who watches television uses primarily the **right** side of his brain more than the left side? On the other side of this fact is the statement that a person who uses a home computer engages the **left** side of his brain!

Prof. William Parks is Assistant Professor of Computer Science and Mathematics at SUNY College at Fredonia, Fredonia, NY.

This simple discovery seems unimportant. But when you learn what functions each side of the brain performs — then it becomes very important to realize that people will be changing their future mental outlooks due to home computing.

When you watch television you are exercising the right side of your brain. This cranial hemisphere recognizes faces, pictures and parts of objects such as you might see on a television screen. Pattern recognition and music appreciation are human talents that emanate mainly from the right side. Also, dreams and fantasies are said to originate there. The human brain is not a single biological organ. Scientists who have studied the two distinct hemispheres have concluded that the right side is the one used when we watch television. Because so much time has been spent watching television, this generation of our society has acquired an overdeveloped right brain and an underdeveloped left brain. When you examine what scientists have already learned about the right side of the brain, you become convinced that our society has truly experienced a setback in left-sided thinking. However, the home computer is now coming to the rescue!

The left side of the human brain is used predominantly to carry out logical thinking, speech, analytical thought processes, and mathematical calculations. Sociologists and physiologists would have to agree that it is the left side that is responsible for human survival and organization. Programming a computer requires logical and sequential thinking. These linear structures require the use of the left side of the brain.

The current generation of children has neglected the left side of the brain because of excessive television viewing. At the same time the standardized national tests given in schools throughout the nation have been dropping each year since the sixties! The two conditions can be correlated. The national tests measure students' abilities to think logically and mathematically. This falling trend is harming the national will to survive (a left brain function). Rational thinking today is generally of poor quality when compared to the fifties or forties in this country when television did not yet take up so much time. In those years television was so new that it did not effect the standardized test scores given in our schools.

A massive acceptance and use of home computers by our children can reverse the unwholesome trend brought on by television. Television is a passive medium. There is no opportunity to react. The viewer absorbs information from television and stores it in memory without any serious analytical response. One authority on the TV medium said, "When you watch television you are training yourself not to react and so, later on, you're doing things without knowing why you're doing them or where the impulses are coming from." — Dr. Eric Peper of San Francisco State University.

When a user of home computers interacts with a good program, the opposite of television viewing takes place. Even game playing with computers requires immediate reactions. This is the key issue. Interrogative or interactive programming via TV-like computer terminals is more wholesome than passive watching of television. It may sound like an exaggeration — but we are weaning a whole generation of young people on television — a passive medium which inhibits logical thinking! It diminishes the natural desire for survival. Programming home computers on a national scale to interact with users will rescue this country from a potentially dangerous effect of dominant right sided thinking. The left side of the brain is more important.

It is my view that men and women who have much experience using computers have a distinct advantage in thinking both logically and analytically. I believe that it is now their obligation to assist the rest of society which lacks these traits common to computer users. □

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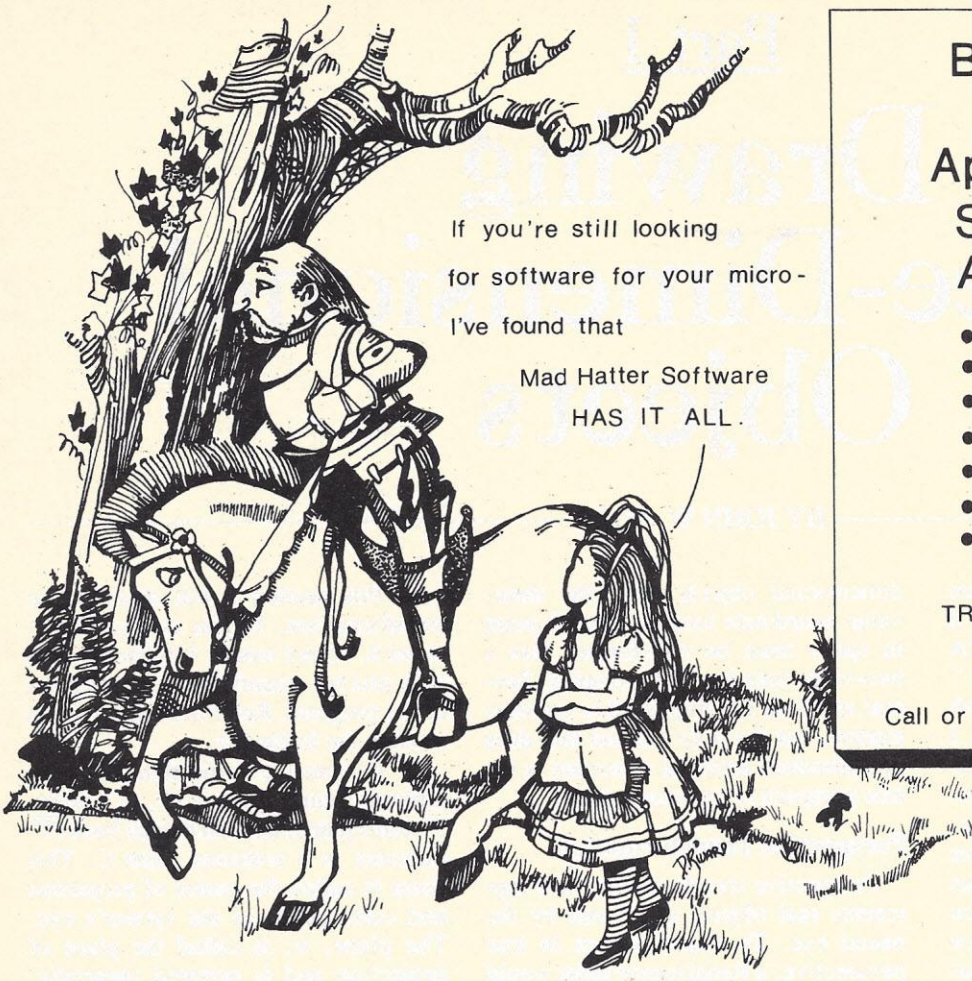

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CIRCLE 17

Part 1

Drawing Three-Dimensional Objects

BY JOHN W. ROSS

A well known saying states, "A picture is worth a thousand words." Well, I'd like to paraphrase this adage to say, "A picture is worth a thousand numbers." If you have spent any time dealing with computer graphics you know what I mean. A quick look at a graph can replace hours poring over a table of numbers searching for patterns. In this case, the graphic capabilities of a computer are well utilized, but this only scratches the surface. Has it ever occurred to you that you could use your micro to draw pictures of solid objects? Such a capability turns out to be very useful and fun as well.

This article presents an easy scheme for making two-dimensional representations of solid objects. The program was written in BASIC and implemented on a Tektronix 4051 Graphic System with a Motorola 6800 microprocessor.

Suppose we want to draw a polyhedron: a closed volume bounded by a number of flat surfaces or planes. These bounding planes can also be referred to as faces. Before we can get a computer to draw such a polyhedron, we must have some way to tell the computer what the object looks like. The easiest way is to record the positions in space of the polyhedron vertices (corners on the object) and specify how they are connected.

For instance, to draw a cube, we would have to tell the computer the positions in space of the eight corners and how they are connected together to form six faces. I will discuss this in more detail later, but first we must consider a more important problem.

In a Cartesian coordinate system, specifying a point in space requires three coordinate values. Specifying a point in a plane though, such as on a plotter or CRT screen, requires only two coordinate values. To draw three-dimensional objects then, the three-value coordinate location of each point in space must be transformed into a two-value location on the display. Several methods accomplish this transformation, but the only method that does not introduce artificial distortion is the true perspective transformation.

Perspective Transformation

Perspective transformation best represents real objects as viewed by the naked eye. To depict scenes in true perspective, a Renaissance artist would observe his subject through a pane of glass, marking locations where the lines between his eye and subject passed through the pane. In effect, we will replace the window with the display screen.

In this section I will describe the transformation. If you do not understand it, do not worry. It is background only and not essential to the application of the program. Refer to Figure 1 while reading the following.

A perspective projection maps an arbitrary point of space, P, to a point, P′, on a plane, π, such that all lines $\overline{PP'}$ intersect in a common point C. This point is called the center of projection and corresponds to the viewer's eye. The plane, π, is called the plane of projection and is oriented perpendicularly to the line of sight, $\overline{CQ}$.

Suppose our object to be drawn is described by points in space, each of which is described by three rectangular coordinates (x, y and z). Suppose also that the observer's eye is situated at

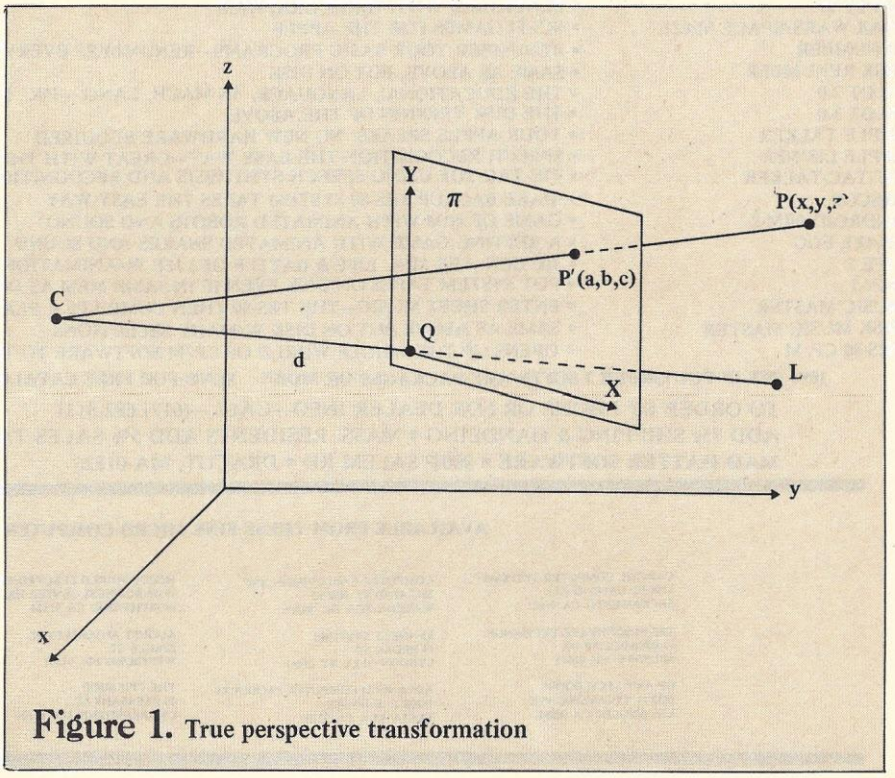


Figure 1. True perspective transformation

point C with coordinates (c_x, c_y, c_z) referring to the same coordinate system. Now, if the observer is looking in the direction of some point, L, his line of sight $\overline{CQL}$ will make angles α, β, and δ with the x, y and z axes respectively. Let the distance, d, between the observer and plane of projection be given, and define the point $Q(q_x, q_y, q_z)$ so that $\overline{CQ} = d$. Construct the plane π through Q such that it is perpendicular to $\overline{CQ}$. Then the line between the arbitrary point, P(x, y, z) and C intersects π at a point P′(a, b, c), which is the perspective image of P in π with respect to C.

Instead of deriving the projection, I will summarize the results. Given the observer's position (c_x, c_y, c_z), the line of sight (i.e., its direction cosines: cos α, cos β, cos δ) and the distance of the plane of projection, d, find the projection of a point in space P(x, y, z), by computing the following:

1) $q_x = c_x + d*\cos\alpha$,
   $q_y = c_y + d*\cos\beta$,
   $q_z = c_z + d*\cos\delta$
2) $K = d/[(x-c_x)*\cos\alpha + (y-c_y)*\cos\beta + (z-c_z)*\cos\delta]$
3) $a = c_x + K*(x-c_x)$,
   $b = c_y + K*(y-c_y)$,
   $c = c_z + K*(z-c_z)$
4) $X = [(a-q_x)*\cos\beta - (b-q_y)*\cos\alpha]/\sin\delta$,
   $Y = (c-q_z)/\sin\delta$

The last step gives the two-dimensional projection of the point, P′, on the plane, π, where X and Y are the planar coordinates. Note that in this step sin δ cannot equal zero. If the line of sight must be vertical (that is, sin $\delta = 0$) an alternate step 4 must be defined:

4) $X = [-(a-q_x)*\cos\delta + (c-q_z)*\cos\alpha]/\sin\beta$,
   $Y = (b-q_y)/\sin\beta$

Arrangement of Data

As I mentioned earlier, the arrangement of data is very important. To illustrate the arrangement I use, let us assume we are drawing the cube in Figure 2. The numbers in brackets are the three-dimensional coordinates of the corners (or vertices) and the circled numbers are the vertex numbers which have been assigned arbitrarily.

The three coordinates are stored in three one-dimensional arrays called X, Y and Z respectively (Table 1). We must also specify the arrangement of the vertices on each face by a two-dimensional array called F (Table 2). Consider this array. There is one row for every face, and one column for each face vertex. Notice that the vertices on each face are ordered cyclically. This ordering is important. Of course, it's not necessary that our object have the same number of vertices on each face; and we could have used an object much more complex than a cube.

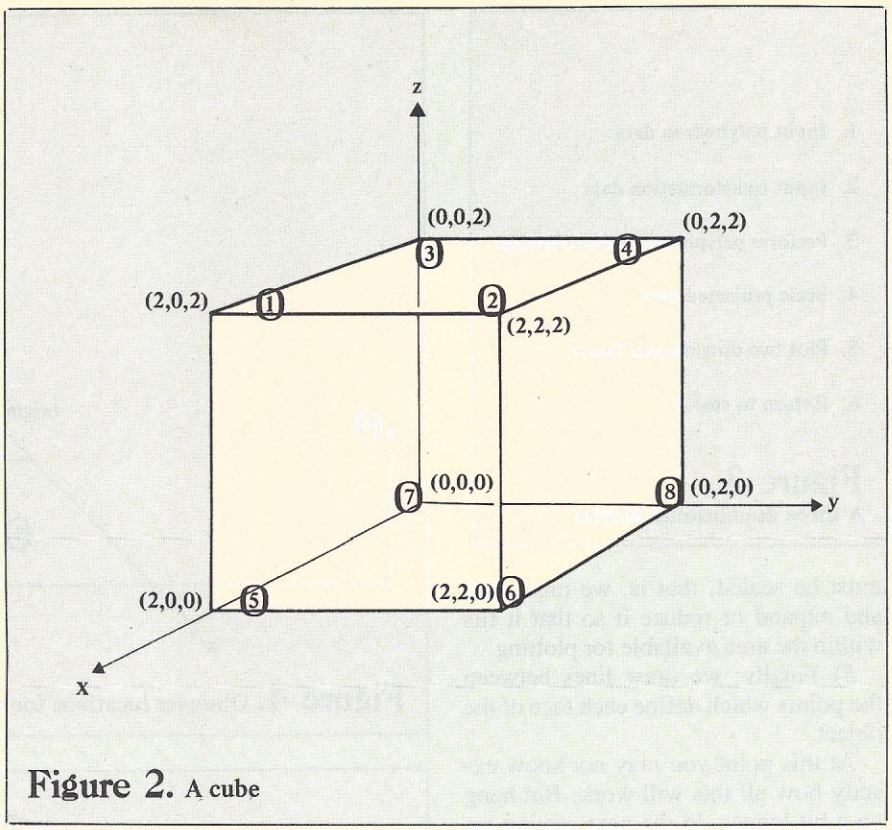


Figure 2. A cube

We now have enough basic information to start putting a program together for actually drawing solid objects.

Plotting System

Our general plotting system follows the steps outlined in Figure 3. Let us look at each of these steps in a little more detail.

1) First we read in the coordinates of the vertices of the object (the arrays X, Y and Z) and the arrangement of the faces (the array F).

2) Next, we input information which directly effects the transformation, including the coordinates of the point C (see Figure 1), and the coordinates of point L.

3) In the transformation step, the perspective transformation is performed according to the algorithm given earlier.

4) Generally, we cannot tell in what range the values of the projected point will lie. The range will not necessarily bear any relation to the actual range in the three-dimensional coordinate values. For this reason the plotted data

Array Location	Contents of Array X	Y	Z
1	2.0	0.0	2.0
2	2.0	2.0	2.0
3	0.0	0.0	2.0
4	0.0	2.0	2.0
5	2.0	0.0	0.0
6	2.0	2.0	0.0
7	0.0	0.0	0.0
8	0.0	2.0	0.0

Table 1. Contents of coordinate arrays X, Y and Z for a cube.

Location	1	2	3	4
1	1	2	6	5
2	2	4	8	6
3	4	3	7	8
4	3	1	5	7
5	1	3	4	2
6	5	6	8	7

Table 2 Contents of array F.

1. Input polyhedron data
2. Input transformation data
3. Perform perspective transformation
4. Scale projected data
5. Plot two dimensional figure
6. Return to step 2

Figure 3.
A three dimensional plotter

must be scaled, that is, we must shift and expand or reduce it so that it fits within the area available for plotting.

5) Finally, we draw lines between the points which define each face of the object.

At this point you may not know exactly how all this will work. But hang on a bit longer. In the next section we will look at the program listing which implements the plotting system. I have put off any programming to this point because I feel things go smoother in the end if you have an overview of what is to be done and some idea of the underlying theory.

Program

The Program Listing follows the steps outlined in Figure 3. Notice that some commands are specific to the 4051. Three of these are PAGE, MOVE and DRAW. PAGE clears the screeen, MOVE x,y moves the cursor to point (x, y) on the screeen and DRAW x,y causes the cursor to draw a line from its present position to the point (x,y). Consider the screen as a 12-unit × 9-unit area. This information is conveyed to the computer through the VIEWPORT and WINDOW commands.

One of the advantages of the 4051 is its advanced graphics capabilty. For your computer, you will have to substitute the appropriate commands for the ones I described. If a 12-unit × 9-unit area is not suitable, you can change the area in line 1030 where the scaling is set up.

Generally, this is how the program works: First it requests data describing the object, then data which determine the view. Now each point is mapped onto a plane and the projected points placed in the two-dimensional array, P. The program checks to see if a viewpoint within the object was specified — in which case the plot would be meaningless. Next, the data in array P are scaled as mentioned earlier to fit in a 12 × 9 area. Note that D0, the distance between the observer and the projection plan, is set equal to one. This value affects the scale of the plot, but because we are scaling it explicitly anyway, the actual value of D0 is irrelevant. Finally the points on each face are connected. The program then returns to request data for a new view. Since the original three-dimensional coordinates have not been touched, these do not need to be input again.

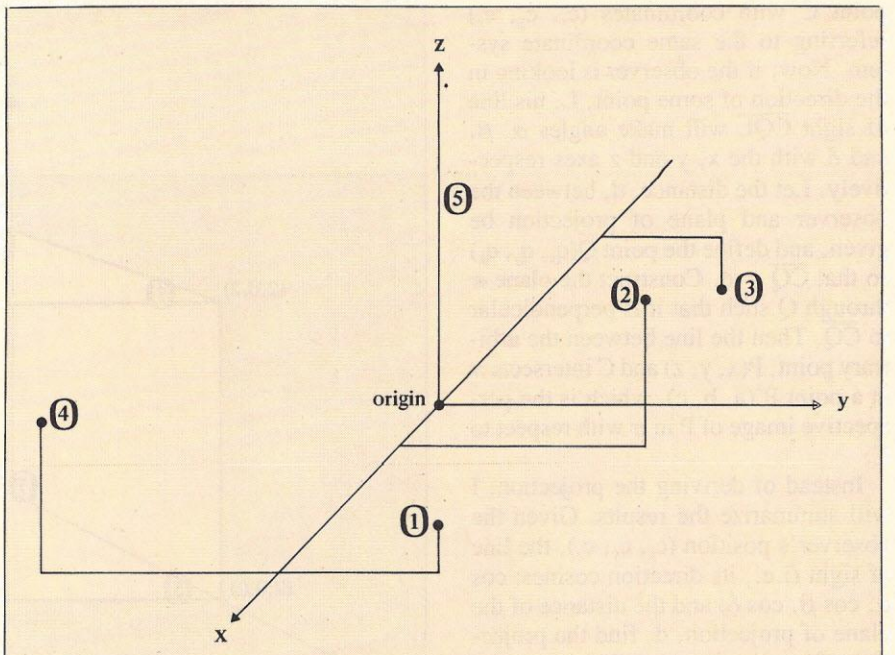


Figure 4. Observer locations for sample run

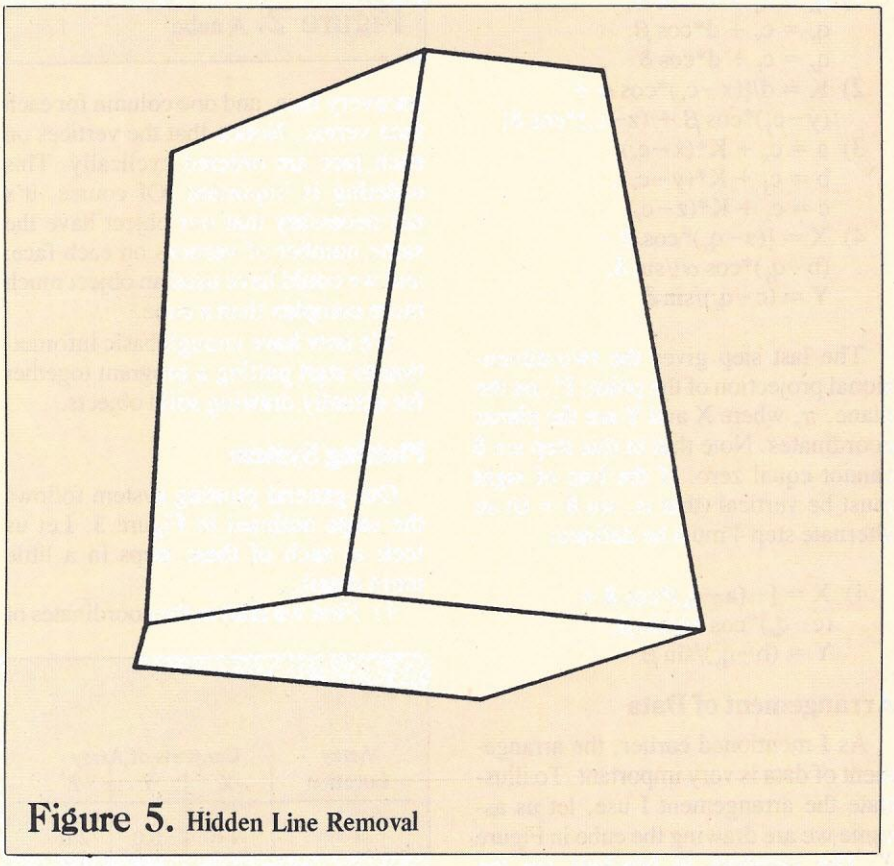


Figure 5. Hidden Line Removal

Sample Run

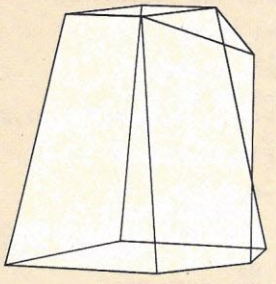
In the Sample Run, the input describes a simple object. Note that a number of projections are produced, which differ only in the observer's location. In each case he is

Sample Run

```
        POLYHEDRON PLOTTING SYSTEM  (J.W. ROSS)
INPUT # OF VERTICES 10
INPUT CARTESIAN COORDINATES OF POLYHEDRON CENTRE
0 0 0
INPUT COORDINATES OF EACH VERTEX IN FORM OF X,Y,Z TRIPLETS
VERTEX
 1. 2 -1 3
 2. 2 1 3
 3. -2 -1 3
 4. -2 1 3
 5. 3 -2 -3
 6. 3 2 -3
 7. -3 -2 -3
 8. -3 2 -3
 9. 0 3 2
 10. 0 3 -3


NOW YOU MUST ENTER FACE ARRANGEMENT INFORMATION
HOW MANY FACES ARE THERE? 8
WHAT IS THE MAXIMUM NUMBER OF VERTICES ON A FACE? 5
WHEN A FACE NUMBER APPEARS--INPUT ITS VERTEX NUMBERS
  ORDERED CYCLICALLY (THESE ARE ENTERED ONE PER LINE)
IF A FACE HAS LESS THAN THE MAX # OF VERTICES - ENTER 0
    AS THE LAST VERTEX NUMBER
FACE 1.
1
2
6
5
0
FACE 2.
2
9
10
```

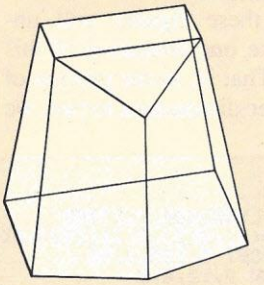
```
7
0
FACE 7.
1
3
4
2
0
FACE 8.
6
10
8
7
5


NEW PLOT - SPECIFY THE FOLOWING :
OBSERVER LOCATION, POINT LOOKED AT
100 50 10 0 0 0
```

```
PARAMETERS :  100 50 10 0 0 0
. . . ANOTHER PLOT? (Y OR N)
```



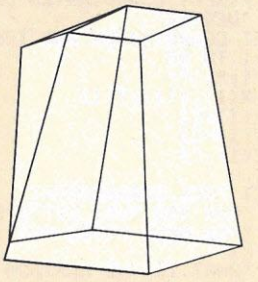
Observer location 1

```
PARAMETERS :  20 100 60 0 0 0
. . . ANOTHER PLOT? (Y OR N) Y
```



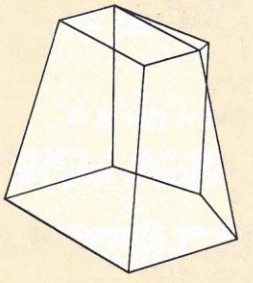
Observer location 2

```
PARAMETERS :  -100 40 -20 0 0 0
. . . ANOTHER PLOT? (Y OR N) Y
```



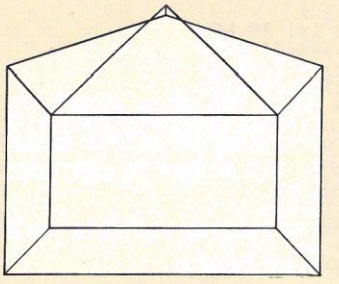
Observer location 3

```
PARAMETERS :  100 -80 60 0 0 0
. . . ANOTHER PLOT? (Y OR N) Y
```



Observer location 4

```
PARAMETERS :  0 0 80 0 0 0
. . . ANOTHER PLOT? (Y OR N) N
```



Observer location 5

looking at the center of the the object, point (0,0,0). The plots should be examined in conjunction with Figure 4, which shows schematically where the observer is located with respect to the origin in each case.

Examining these figures will undoubtedly make one limitation of this system clear. That is, in the process of going from three dimensions to two, we lose all depth information about the object we are looking at, producing ambiguities in the drawings. It's not clear what we are looking at or from which direction. Sometimes this ambiguity is acceptable; but sometimes, as in the view from observer location 3, the situation can be very confusing.

One solution to this problem is to remove the hidden lines; that is, lines which are obscured by nearer faces should not be drawn. Figure 5 is a reproduction of the view from location 3 with the hidden lines removed. Defining the object is much easier to understand. In the concluding article, I will show how to remove hidden lines from a plot, and how to retrieve the original depth information contained in these two-dimensional drawings. □

Program Listing

```
50 REM POLYHEDRON PLOTTER
100 DIM D(6),Q(3),C(3),U(3),A(3),V(3)
110 VIEWPORT 5,125,5,95
120 WINDOW 0,12,0,9
130 PAGE
140 DELETE X,Y,Z,P,F,V1
150 PRINT "      POLYHEDRON PLOTTING SYSTEM  (J.W. ROSS)"
160 REM IN THIS SECTION POLYHEDRON DATA IS INPUT
170 PRINT "INPUT # OF VERTICES ";
180 INPUT N0
190 DIM X(N0),Y(N0),Z(N0),P(N0,2)
200 PRINT "INPUT CARTESIAN COORDINATES OF POLYHEDRON CENTRE"
210 INPUT C1,C2,C3
220 PRINT "INPUT COORDINATES OF EACH VERTEX IN FORM OF X,Y,Z TRIPLETS"
230 PRINT "VERTEX"
240 REM GET COORDINATES AND TRANSLATE TO ORIGIN
250 FOR I=1 TO N0
260 PRINT I;". ";
270 INPUT X(I),Y(I),Z(I)
280 X(I)=X(I)-C1
290 Y(I)=Y(I)-C2
300 Z(I)=Z(I)-C3
310 NEXT I
320 REM GET FACE ARRANGEMENT
330 PRINT "NOW YOU MUST ENTER FACE ARRANGEMENT INFORMATION"
340 PRINT "HOW MANY FACES ARE THERE? ";
350 INPUT N1
360 PRINT "WHAT IS THE MAXIMUM NUMBER OF VERTICES ON A FACE? ";
370 INPUT N2
380 DIM F(N1,N2),V1(N1)
390 PRINT "WHEN A FACE NUMBER APPEARS--INPUT ITS VERTEX NUMBERS"
400 PRINT "  ORDERED CYCLICALLY (THESE ARE ENTERED ONE PER LINE)"
410 PRINT "IF A FACE HAS LESS THAN THE MAX # OF VERTICES - ENTER 0"
420 PRINT "    AS THE LAST VERTEX NUMBER"
430 FOR I=1 TO N1
440 PRINT "FACE ";I;"."
450 FOR J=1 TO N2
460 INPUT F(I,J)
470 IF F(I,J)=0 THEN 500
480 NEXT J
490 J=N2+1
500 V1(I)=J-1
510 NEXT I
520 REM START A NEW PLOT
530 PAGE
540 PRINT "NEW PLOT - SPECIFY THE FOLOWING :"
550 PRINT "OBSERVER LOCATION, POINT LOOKED AT"
560 INPUT D
570 D0=1
580 REM PERFORM PERSPECTIVE TRANSFORMATION
590 U(1)=D(4)-D(1)
600 U(2)=D(5)-D(2)
610 U(3)=D(6)-D(3)
620 U1=SQR(U(1)*U(1)+U(2)*U(2)+U(3)*U(3))
630 FOR I=1 TO 3
640 C(I)=U(I)/U1
650 NEXT I
660 S3=SQR(1-C(3)*C(3))
670 S2=SQR(1-C(2)*C(2))
680 FOR I=1 TO 3
690 Q(I)=D(I)+D0*C(I)
700 NEXT I
710 FOR I=1 TO N0
720 V(1)=X(I)-D(1)
730 V(2)=Y(I)-D(2)
740 V(3)=Z(I)-D(3)
750 REM CHECK FOR VALID VIEWPOINT
760 IF V(1)*V(1)+V(2)*V(2)+V(3)*V(3)>0 THEN 810
770 PRINT "VIEWPOINT WITHIN OBJECT - PLOT ABANDONED"
780 PRINT "HIT RETURN TO CONTINUE"
790 INPUT A$
800 GO TO 530
810 K=D0/(V(1)*C(1)+V(2)*C(2)+V(3)*C(3))
820 FOR J=1 TO 3
830 A(J)=D(J)+K*V(J)
840 NEXT J
850 IF S3=0 THEN 890
860 P(I,1)=((A(1)-Q(1))*C(2)-(A(2)-Q(2))*C(1))/S3
870 P(I,2)=(A(3)-Q(3))/S3
880 GO TO 910
890 P(I,1)=((Q(1)-A(1))*C(3)+(A(3)-Q(3))*C(1))/S2
900 P(I,2)=(A(2)-Q(2))/S2
910 NEXT I
920 REM SCALE THE DATA SO IT FITS INTO A 12X9 AREA
930 X1=P(1,1)
940 X2=P(1,1)
950 Y1=P(1,2)
960 Y2=P(1,2)
970 FOR I=2 TO N0
980 X1=X1 MIN P(I,1)
990 X2=X2 MAX P(I,1)
1000 Y1=Y1 MIN P(I,2)
1010 Y2=Y2 MAX P(I,2)
1020 NEXT I
1030 T=9/(Y2-Y1) MIN 12/(X2-X1)
1040 FOR I=1 TO N0
1050 P(I,1)=(P(I,1)-X1)*T
1060 P(I,2)=(P(I,2)-Y1)*T
1070 NEXT I
1080 REM DRAW THE POLYHEDRON
1090 PAGE
1100 FOR I=1 TO N1
1110 K=F(I,1)
1120 MOVE P(K,1),P(K,2)
1130 FOR J=2 TO V1(I)
1140 DRAW P(F(I,J),1),P(F(I,J),2)
1150 NEXT J
1160 DRAW P(K,1),P(K,2)
1170 NEXT I
1180 MOVE -0.5,9.5
1190 PRINT "PARAMETERS : ";
1200 PRINT D(1);D(2);D(3);D(4);D(5);D(6);
1210 PRINT "  . . . ANOTHER PLOT? (Y OR N) ";
1220 INPUT A$
1230 IF A$="Y" THEN 530
1240 END
```

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CIRCLE 14

Economic Order Quantity

BY ADRIAN WOODS

Economic Order quantity, a familiar inventory control technique, gives optimum order quanity and optimum reorder point. EOQ answers the questions: "When should I reorder?" and "How much should I reorder?"

I've modeled four types of EOQ in the following program: classical EOQ, EOQ with lead time, EOQ with back orders and EOQ with a stochastic demand. I wanted a program useful both as an aid in teaching EOQ and for small businesses.

The first part of the program gives a menu of available models. Inputting the initial letter of any model switches the program to that model. New users should start off with the classical EOQ model, where I've included the required assumptions.

You're asked to input the following information: (1) demand per period of time; (2) ordering cost per order; (3) holding cost per period of time. With this information and the EOQ formula, the program outputs the order size which minimizes total inventory cost per time period: Economic Order Quantity.

Successive models relax the assumptions of the first model.

The next model introduces EOQ with lead time. Although the optimum reorder quantity is unaffected by the length of the lead time, an optimum reorder point has to be determined. This model asks for the following information: (1) lead time; (2) demand per period of time; (3) ordering cost per order; (4) holding cost per period of time.

As with the first model, the program Binds:(1) Economic Order Quantity; (2) inventory cycle; (3) optimum reorder point.

The next model lets you introduce back orders. A common business situation occurs when you have a trade off between ordering cost and carrying cost on the one hand and back ordering cost on the other. Businesses can often lower inventory costs by reducing both the number of orders placed and the number of items stored. The trade off occurs when you occasionally cannot meet demand, resulting in a loss of business. If a cost can be attached to this loss of business, we can formulate a model that gives the optimal order quantity and the optimum reorder point.

Sample Run

```
    THIS PROGRAM CONTAINS THE FOLLOWING MODELS
  CLASSICAL ECONOMIC ORDER QUANTITY
  ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD TIME
  WITH BACKORDERS
  STOCHASTIC MODEL
     INPUT KEY CHARACTER TO CALL UP REQUIRED MODEL
C



 CLASSICAL ECONOMIC ORDER QUANTITY MODEL
 ***************************************

MODEL ASSUMPTIONS
     DEMAND PER PERIOD (D) IS KNOWN AND IS CONSTANT
    LEAD TIME EQUALS ZERO
     STOCKOUTS ARE NOT PERMISSABLE
    THE  ENTIRE ORDER IS RECEIVED IN ONE BATCH
     ORDER QUANTITIES (Q) ARE CONSTANT
     CONSTANT UNIT COSTS FOR ITEMS
     SINGLE ITEMS ASSUMED
     INFINITE PLANNING HORIZON
     DEMAND,LEAD TIME,AND COSTS ARE CONSTANT
            TO CONTINUE PRESS ANY KEY
M

    INPUT DEMAND PER TIME PERIOD

 1000
     INPUT ORDERING COST PER ORDER

 10
     INPUT HOLDING COST

 2
       ECONOMIC ORDER QUANTITY IS
      *******************************

            100
     ANOTHER PROBLEM
YES

    INPUT DEMAND PER TIME PERIOD

 1000
     INPUT ORDERING COST PER ORDER

 15
     INPUT HOLDING COST

 2
```

```
          ECONOMIC ORDER QUANTITY IS
         ******************************

                 122.474487
          ANOTHER PROBLEM
 YES

      INPUT DEMAND PER TIME PERIOD

  1000
      INPUT ORDERING COST PER ORDER

  20
      INPUT HOLDING COST

  2
          ECONOMIC ORDER QUANTITY IS
         ******************************

                 141.421356
          ANOTHER PROBLEM
 NO
      INPUT E TO EXIT
 N


   THIS PROGRAM CONTAINS THE FOLLOWING MODELS
  CLASSICAL ECONOMIC ORDER QUANTITY
  ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD TIME
  WITH BACKORDERS
  STOCHASTIC MODEL
    INPUT KEY CHARACTER TO CALL UP REQUIRED MODEL
E


ECONOMIC ORDER QUANTITY WITH LEAD TIME
**************************************

ASSUMPTIONS OF MODEL
1     AS FOR CLASSICAL ECONOMIC ORDER QUANTITY
2     EXCEPT POSITIVE LEAD TIME
      PRESS ANY KEY TO CONTINUE
N

INPUT LEAD TIME

 .01
INPUT DEMAND
 1000
INPUT ORDERING COST
 10
INPUT HOLDING COST
 2


ECONOMIC ORDER QUANTITY
                100
INVENTORY CYCLE
                .1
OPTIMUM REORDER POINT
                10
  PRESS E TO CONTINUE
E



   THIS PROGRAM CONTAINS THE FOLLOWING MODELS
  CLASSICAL ECONOMIC ORDER QUANTITY
  ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD TIME
  WITH BACKORDERS
  STOCHASTIC MODEL
    INPUT KEY CHARACTER TO CALL UP REQUIRED MODEL
E
```

In this model you input: (1) demand per period of time; (2) ordering cost per order; (3) holding cost per period of time; (4) shortage cost. From this data the following is found: (1) Economic Order Quantity; (2) maximum shortage that will occur.

The final model introduces a stochastic demand. The three previous models implicitly assumed that demand is deterministic. Although these models give a reasonable approximation of common business situations, they lack a certain realism. A model that directly introduces uncertainty is often more appropriate in certain circumstances.

Stochastic demand refers to a random pattern of demand based on a specific probabilty distribution. For example, demand could be normally distributed with a mean of 100 and a standard deviation of 10. Or it could follow a Poisson Distribution. From these distributions demand is generated. An example will clarify this point. Suppose demand is based on a normal distribution with a mean of 100 and a standard deviation of 10. We can associate a specific probability with each possible level of demand. Using the normal tables and the information above shows us that the probability of a demand of 90 is .0758. We can find other possible demand levels in a similar manner.

The final model uses this idea of stochastic demand. The model assumes that the actual demand per time period is deterministic and is equal to the mean expected demand in the lead time multiplied by the number of lead times in the period. If the lead time is 4 weeks and demand is calculated on a 52-week period, the number of lead times in the period would be 13. The stochastic part then refers to the distribution of demand within the lead time. The mean expected demand within the time is simply the average demand for that period.

Unlike many formulations using stochastic demand, my model does not specify an actual distribution; I leave this to you. You must input information on lead time demand in the following form: (1) number of class intervals; (2) mid-points and frequency per class interval.

Let's look at an example. Suppose that over the course of 200 weeks you have recorded the demand for a certain part per lead time period. The lead time for this part is 4 weeks. From this information, you can create the following table:

Demand	Frequency
0-10	1
10-20	2
20-30	4
30-40	4
40-50	11
50-60	20
60-70	3
70-80	2
80-90	2
90-100	1

Demand was between 0 and 10 once in the 50 lead times observed; twice it fell between 10 and 20; and so on. From this table you can calculate the mean demand per lead time: 50.664 parts.

Input required for this model is: (1) demand per period of time; (2) holding cost per period of time; (3) ordering cost per order; (4) penalty cost per unit backordered. For (5) the stochastic process, you input: (i) number of class intervals; (ii) mid points and frequency. From this data the program calculates the Economic Order Quantity and the reorder point.

The program was written on a Commodore Pet using Pet BASIC. The program contains graphic symbols peculiar to this system, but a few obvious alterations in output format should allow the program to run on most versions of BASIC.

Sample Run Notes

First, the program prints a menu of the four models available. To call up a model, input its initial letter. The first model called up in the Sample Run is the Classical Economic Order Quantity model. After the assumptions of the model have been printed, the user inputs the following information: a demand of 1000, ordering costs of £10 and holding cost of £2. The Economic Order Quantity is printed.

For this model, you can calculate another EOQ without going back to the menu. The user chooses this option and inputs the same parameters except that ordering cost has gone up from £10 to £15. This new data results in a new EOQ of 122.47. Again ordering costs are changed, this time to £20. The new EOQ is 141.42. You can see the impact on EOQ of increasing ordering costs.

Now the user goes back to the menu and calls up the second model by inputting the key initial E. This model introduces a lead time component. In the sample run, the user inputs a lead time of .02 of a year. The other parameters are as shown. The result is an EOQ of 100 with a reorder point of 20.

The next model selected includes the possibility of back orders. The parameters for this model are: demand, 1000; ordering cost, £10; holding cost, £2; and shortage cost, £20. given these values, the EOQ of 104.88 with a maximum shortage of 9.53 is calculated.

Now the user calls up the model that allows for stochastic demand within the lead time. From the data the program calculates an EOQ of 81.11 with a reorder point of 85; that is, whenever the stock falls below 85, an order of 81 should be put in. This model is used again with a new holding cost of £10, giving in a new EOQ of 36.27 and a reorder point of 5.

The last part of the Sample Run shows how the program can test the sensitivity of certain parameters, varying one component to see the effect on EOQ. In the example above, a change of holding cost from £2 to £20 changed EOQ from about 81 to about 36, with a consequence change in reorder point. Testing sensitivity is particularly useful when some of the parameters are only roughly known. Trying various estimates shows you which elements are sensitive to change and which are not. □

Variables

C$	Key Letter For Menu: C for a Classic Economic Order Quantity; E for EOQ with LeadTime; W for EOQ with Back Orders; S for Stochastic Model
A$	Continuation Key
A	FOR loop variable control output speed
D	Demand per time period
C	Ordering Cost per Order
H	Holding Cost
Q	Economic Order Quantity
T	Lead Time
L	Length of Inventory Cycle
R	Reorder Point
S	Shortage Cost and Maximum Shortage
M(A)	Array to store Mid-Points
F(A)	Array to store Frequencies
T1	Cumulative Frequency
A1	Count Variable
Q1	Ecit Variable

Sample Run continued

```
ECONOMIC ORDER QUANTITY WITH LEAD TIME
**************************************

ASSUMPTIONS OF MODEL
1      AS FOR CLASSICAL ECONOMIC ORDER QUANTITY
2      EXCEPT POSITIVE LEAD TIME
       PRESS ANY KEY TO CONTINUE
M

INPUT LEAD TIME

 .02
INPUT DEMAND
 1000
INPUT ORDERING COST
 10
INPUT HOLDING COST
 2


ECONOMIC ORDER QUANTITY
                100
INVENTORY CYCLE
                .1
OPTIMUM REORDER POINT
                20
  PRESS E TO CONTINUE
E



   THIS PROGRAM CONTAINS THE FOLLOWING MODELS
 CLASSICAL ECONOMIC ORDER QUANTITY
 ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD TIME
 WITH BACKORDERS
 STOCHASTIC MODEL
    INPUT KEY CHARACTER TO CALL UP REQUIRED MODEL
W
```

```
ECONOMIC ORDER QUANTITY WITH BACKORDERS
.......................................

    1   AS FOR CLASSICAL ECONOMIC ORDER QUANTITY
    2   WITH BACKORDERS
PRESS ANY KEY TO CONTINUE
    INPUT  DEMAND
 10
    INPUT  ORDERING COST
 2
    INPUT  HOLDING COST
 20
    INPUT  SHORTAGE COST
 60
    ECONOMIC ORDER QUANTITY
 104.880885
    MAXIMUM SHORTAGE
 9.5346259
PRESS E TO CONTINUE
E

   THIS PROGRAM CONTAINS THE FOLLOWING
 MODELS CLASSICAL ECONOMIC ORDER QUANTITY
 ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD
 TIME WITH BACKORDERS
 STOCHASTIC MODEL
   INPUT KEY CHARACTER TO CALL UP
 REQUIRED MODEL
 S


STOCHASTIC MODELS
.................

    EOQ WITH STOCHASTIC DEMAND
    ..........................
    INPUT  DEMAND
 658
    INPUT  HOLDING COST
 2
    INPUT  ORDERING COST
 10
    INPUT  PENALTY COST PER UNIT BACKORDERED

 10
NOW INPUT THE STOCHASTIC PROCESS

INPUT NUMBER OF CLASS INTERVALS
 10
  INPUT  MID POINT,FREQUENCY
 5              1
  INPUT  MID POINT,FREQUENCY
 15             2
  INPUT  MID POINT,FREQUENCY
 25             4
  INPUT  MID POINT,FREQUENCY
 35             4
  INPUT  MID POINT,FREQUENCY
 45             11
  INPUT  MID POINT,FREQUENCY
 55             20
  INPUT  MID POINT,FREQUENCY
 65             3
  INPUT  MID POINT,FREQUENCY
 75             2
  INPUT  MID POINT,FREQUENCY
 85             2
  INPUT  MID POINT,FREQUENCY
 95             1
    ECONOMIC ORDER QUANTITY
            81.1171992
    REORDER POINT
            85
  PRESS E TO CONTINUE
E

   THIS PROGRAM CONTAINS THE FOLLOWING
 MODELS CLASSICAL ECONOMIC ORDER QUANTITY
 ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD
 TIME WITH BACKORDERS
 STOCHASTIC MODEL
   INPUT KEY CHARACTER TO CALL UP
 REQUIRED MODEL
 S


STOCHASTIC MODELS
.................

    EOQ WITH STOCHASTIC DEMAND
    ..........................
    INPUT  DEMAND
 658
    INPUT  HOLDING COST
 10
    INPUT  ORDERING COST
 10
    INPUT  PENALTY COST PER UNIT BACKORDERED

 10
NOW INPUT THE STOCHASTIC PROCESS

INPUT NUMBER OF CLASS INTERVALS
 10
  INPUT  MID POINT,FREQUENCY
 5              1
  INPUT  MID POINT,FREQUENCY
 15             2
  INPUT  MID POINT,FREQUENCY
 25             4
  INPUT  MID POINT,FREQUENCY
 35             4
  INPUT  MID POINT,FREQUENCY
 45             11
  INPUT  MID POINT,FREQUENCY
 55             20
  INPUT  MID POINT,FREQUENCY
 65             3
  INPUT  MID POINT,FREQUENCY
 75             2
  INPUT  MID POINT,FREQUENCY
 85             2
  INPUT  MID POINT,FREQUENCY
 95             1
    ECONOMIC ORDER QUANTITY
            36.2767143
    REORDER POINT
            5
  PRESS E TO CONTINUE
N
    BYE FOR NOW
.
READY.
```

Program Listing

```
10 REM ECONOMIC ORDER QUANTITY
20 REM ADRIAN WOODS 1978
30 REM PNL
90 REM MODELS SPECIFIED
95 REM**************************
100 PRINT "    THIS PROGRAM CONTAINS THE FOLLOWING MODELS"
110 PRINT "  CLASSICAL ECONOMIC ORDER QUANTITY"
120 PRINT "  ECONOMIC ORDER QUANTITY QUANTITY WITH LEAD TIME"
130 PRINT "  WITH BACKORDERS"
140 PRINT "  STOCHASTIC MODEL"
150 PRINT "     INPUT KEY CHARACTER TO CALL UP REQUIRED MODEL"
155 REM INPUT KEY LETTER FROM MENU
156 REM**************************
160 INPUT C$
170 IF C$="C" THEN 1000
180 IF C$="E" THEN 2099
190 IF C$="W" THEN 2500
200 IF C$="S" THEN 3000
205 REM CHECK FOR EXIT FROM PROGRAM
206 REM**************************
210 PRINT "    TO EXIT TYPE 999 ELSE TYPE ANY NUMBER TO CONTINUE "
220 INPUTQ1
230 IF Q1=999 THEN 8000
235 PRINT ""
240 GOTO 110
1000 PRINT ""
1100 REM EOQ SECTION
1101 REM**************************
1200 PRINT "";
1300 PRINT " CLASSICAL ECONOMIC ORDER QUANTITY MODEL"
1310 PRINT " ****************************************"
1400 PRINT ""
1500 FOR A=1 TO 3000:NEXT A
1600 PRINT ""
1700 PRINT "MODEL ASSUMPTIONS"
1705 PRINT "";
1720 PRINT "     DEMAND PER PERIOD (D) IS KNOWN AND IS CONSTANT"
1730 PRINT "    LEAD TIME EQUALS ZERO"
1740 PRINT "     STOCKOUTS ARE NOT PERMISSABLE"
1750 PRINT "    THE  ENTIRE ORDER IS RECEIVED IN ONE BATCH"
1760 PRINT "     ORDER QUANTITIES (Q) ARE CONSTANT"
2405 REM CALCULATE EOQ
2406 REM**************************
2410 Q=SQR(2*D*O/H)
2420 L=Q/D
2430 R=T*D-(INT(T/L)*Q)
2440 PRINT "ECONOMIC ORDER QUANTITY"
2450 PRINT "                ";Q
2460 PRINT "INVENTORY CYCLE"
2470 PRINT "                ";L
2480 PRINT "OPTIMUM REORDER POINT"
2490 PRINT "                ";R
2495 PRINT "  PRESS E TO CONTINUE"
2496 INPUTA$
2497 IF A$="E" THEN 100
2498 GOTO 8000
2499 REM EOQ WITH BACKORDERS
2500 PRINT "ECONOMIC ORDER QUANTITY WITH BACKORDERS"
2510 PRINT "**************************************"
2515 FOR A=1 TO 4000:NEXT A
2516 PRINT ""
2520 PRINT "    1   AS FOR CLASSICAL ECONOMIC ORDER QUANTITY"
2530 PRINT "    2   WITH BACKORDERS"
2540 PRINT "PRESS ANY KEY TO CONTINUE":INPUT A$
2560 PRINT "    INPUT  DEMAND"
2570 PRINT "":INPUT D
2580 PRINT "    INPUT  ORDERING COST"
2590 INPUTO
2600 PRINT "    INPUT HOLDING COST"
2610 INPUTH
2620 PRINT "     INPUT  SHORTAGE COST"
2630 INPUTS
2640 FOR A=1 TO 1000:NEXT A
2650 PRINT "    ECONOMIC ORDER QUANTITY   "
2655 REM CALCULATE EOQ
2656 REM**************************
2660 Q=SQR((2*D*O/H)*((H+S)/S))
2670 PRINT Q
2680 PRINT "    MAXIMUM SHORTAGE    "
2685 REM CALCULATE MAX SHORTAGE
2686 REM **************************
2690 S=SQR((2*O*D*H)/((H*S)+(S*S)))
```

```
1770 PRINT "     CONSTANT UNIT COSTS FOR ITEMS"
1780 PRINT "     SINGLE ITEMS ASSUMED"
1790 PRINT "     INFINITE PLANNING HORIZON"
1800 PRINT "     DEMAND,LEAD TIME,AND COSTS ARE CONSTANT"
1810 PRINT "            TO CONTINUE PRESS ANY KEY"
1815 INPUTA$
1830 PRINT ""
1840 PRINT "    INPUT DEMAND PER TIME PERIOD"
1850 PRINT ""
1860 INPUTD
1870 PRINT "     INPUT ORDERING COST PER ORDER"
1880 PRINT ""
1890 INPUTC
1900 PRINT "     INPUT HOLDING COST"
1910 PRINT""
1920 INPUTH
1925 REM CALCULATE EOQ
1926 REM**************************
1930 Q=SQR(2*D*C/H)
1940 PRINT "       ECONOMIC ORDER QUANTITY IS "
1945 PRINT "     ****************************
1950 PRINT "           ";Q
1960 PRINT "     ANOTHER PROBLEM"
1970 INPUTA$:IFA$="YES"THEN1830
2090 PRINT "     INPUT E TO EXIT":INPUT A$
2091 IF A$="E" THEN 8000
2092 PRINT ""
2093 GOTO 100
2099 PRINT ""
2100 PRINT "      "
2105 REM EOQ WITH LEAD TIME SECTION
2106 REM**************************
2110 PRINT "ECONOMIC ORDER QUANTITY WITH LEAD TIME "
2120 PRINT "**************************************
2200 FOR A=1 TO 4000:NEXT A
2210 PRINT "ASSUMPTIONS OF MODEL"
2220 PRINT "1     AS FOR CLASSICAL ECONOMIC ORDER QUANTITY "
2230 PRINT "2     EXCEPT POSITIVE LEAD TIME"
2240 PRINT "      PRESS ANY KEY TO CONTINUE"
2250 INPUTA$
2260 PRINT ""
2300 PRINT"INPUT LEAD TIME"
2310 PRINT "":INPUT T
2320 PRINT "INPUT DEMAND"
2340 INPUTD
2350 PRINT "INPUT ORDERING COST"
2360 INPUTO
2370 PRINT "INPUT HOLDING COST"
2380 INPUTH
2390 FOR A=1 TO 3000:NEXT A:PRINT ""
2400 PRINT "     "
2700 PRINT S
2991 PRINT "PRESS E TO CONTINUE"
2992 INPUTA$
2993 IF A$="E" THEN 100
2994 GOTO 8000
2995 REM STOCHASTIC MODEL
2996 REM **********************
3000 PRINT "STOCHASTIC MODELS"
3001 PRINT "*****************
3005 PRINT "      EOQ WITH STOCHASTIC DEMAND"
3006 PRINT "     ****************************
3010 FOR A=1 TO 4000:NEXT A
3100 PRINT "     INPUT  DEMAND"
3105 INPUTD
3110 PRINT "     INPUT  HOLDING COST"
3120 INPUTH
3130 PRINT "     INPUT  ORDERING COST"
3140 INPUTO
3150 PRINT "     INPUT  PENALTY COST PER UNIT BACKORDERED"
3160 PRINT "":INPUT S
3170 PRINT "NOW INPUT THE STOCHASTIC PROCESS"
3175 FOR A=1 TO 1500:NEXT A
3180 PRINT "      "
3190 PRINT "INPUT NUMBER OF CLASS INTERVALS"
3200 INPUT C
3210 FOR A=1 TO C
3220 PRINT "  INPUT  MID POINT,FREQUENCY"
3230 INPUTM(A),F(A)
3240 T1=T1+F(A)
3250 NEXT A
3260 FOR A=1 TO C
3270 F(A)=F(A)/T1
3280 NEXT A
3290 REM CALCULATE EOQ
3295 REM **********************
3300 Q=SQR(2*D*O/H)
3310 R=1-((Q*H)/(S*D))
3315 A1=0
3320 A1=A1+1
3330 Z=Z+F(A1)
3340 IF Z>R THEN 3350
3345 GOTO 3320
3350 PRINT "     ECONOMIC ORDER QUANTITY"
3360 PRINT "            "Q
3370 PRINT "     REORDER POINT "
3380 PRINT "           "M(A1)
3430 PRINT "  PRESS E TO CONTINUE"
3440 INPUTA$
3450 IF A$="E" THEN 100
8000 PRINT "     BYE FOR NOW"
READY.
```

Color. VP-590 add-on Color Board allows program control of 8 brilliant colors for graphics, color games. Plus 4 selectable background colors. Includes sockets for 2 auxiliary keypads (VP-580). $69.*

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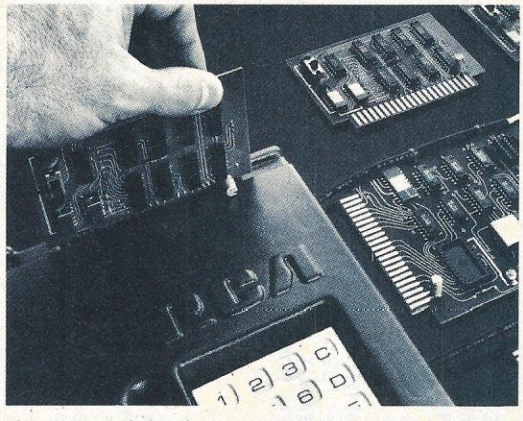

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The fun way into computers.

RCA

CIRCLE 21

RENT

Help for the Weary Landlord

BY FRED E. GUTH

I'm a one-tenant landlord, and that one tenant drives me looney. He's a real slow-pay!

The last time my tenant and I agreed on a lease, I insisted that an interest of 1½% per month be included for late payment. Since then I've learned that most landlords charge interest for late rent payments.

Until I purchased my TRS-80, I nearly regretted the 1½% add-on. It required a lot of figuring with paper and pencil. But now, with my little Rent program — strictly homemade but darned effective — life is simpler.

You could include 100 or more tenants in the program. And each one is separated and totalled so the printout is clear and concise. You get the total rent due, the interest due and the accumulated amount due from each tenant. After tabulating all tenants, the program gives a recap showing the grand totals.

You must turn on the printer when the program begins. Lines 50 and 60 prompt you with a reminder.

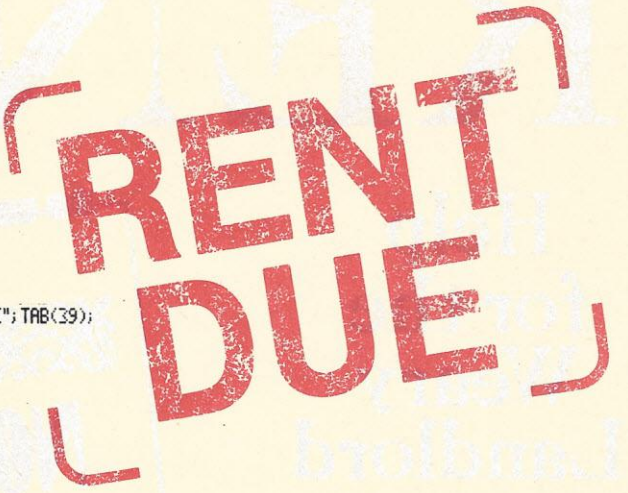
Rent asks three basic questions for each tenant: name, amount of rent per month, and the interest charged this tenant. From there on, there are just two questions each time a tenant repeats.

In the Sample Run, Glaser Drug Co. owes four months rent. Lines 170 to 200 ask the tenant's name, his rent per month and the agreed-to interest. Then lines 220 and 230 request the date the rent was due and the number of months it is overdue. When this data is typed in, a question appears (line 290) asking if this tenant owes for another month. If you type Y for "yes", the program jumps back to line 230 for two more questions for the next month. If you type N for "no", the program lines-off that tenant, and prints up the totals for that tenant.

After the last tenant's data is printed, another question appears (line 330): "Do you have another tenant past due?" On N, the program recaps the totals of all rents due and the accumulated totals of interest and rents due.

Program Listing

```
10 REM   "RENT PROGRAM"  -- FILENAME "RENT"
20 REM
30 REM    LISTING & CALCULATING RENT RECEIVABLES
40 REM
50 CLEAR999:CLS:PRINTCHR$(23)"TURN ON THE LINE PRINTER"
60 INPUT"PRESS ENTER TO CONTINUE";S
70 OO=0:SS=0:WW=0
80 BB=0:BC=0:BD=0
100 CLS:LINEINPUT"THE BUILDING NAME IS -";A$
110 LINEINPUT"THE DATE OF THIS REPORT IS-";B$
120 LPRINT"THIS REPORT IS OF THE -";A$
130 LPRINT"DATE OF THIS REPORT IS -";B$
140 LPRINTSTRING$(36,45):LPRINT" "
150 LPRINT"NAME OF TENANT-";TAB(18);"DATE DUE";TAB(28);"RENT DUE";TAB(39);
    "INTEREST";TAB(51);"TOTAL";TAB(61);"ACCUM."
160 LPRINTSTRING$(66,45)
170 CLS:LINEINPUT"ENTER NAME OF THE TENANT -";C$
180 OO=0:SS=0:WW=0
190 INPUT"ENTER THE AMOUNT OF RENT PER MONTH -";R
200 INPUT"THE INTEREST CHARGED PER MONTH (IN %) IS -";I
210 PRINT
220 LINEINPUT"ENTER DATE THIS RENT WAS DUE (MM/DD/YY) -";D$
230 INPUT"ENTER THE NUMBER OF MONTHS THIS IS OVERDUE -";M
240 J=I/100:CA=M*(R*J)
250 DA=INT((CA+.005)*100)/100
260 EA=DA+R
270 OO=OO+R:SS=SS+DA:WW=WW+EA
280 LPRINTC$;TAB(18);D$;TAB(28);R;TAB(36);I"%";TAB(43);DA;TAB(49);EA;TAB(59);WW
290 PRINT:XC$=" ":INPUT"DO YOU WANT TO ADD ANOTHER ITEM FOR THIS TENANT (Y OR N) -";XC$:XC$=LEFT$(XC$,1):IFXC$="Y"THENGOTO210
300 IF XC$="N"THENGOTO310
310 LPRINTSTRING$(66,45):LPRINT"TOTALS -";TAB(28);OO;TAB(43);SS;TAB(59);WW:LPRINT" "
320 BB=BB+OO:BC=BC+SS:BD=BB+BC
330 CLS:INPUT"DO YOU HAVE ANOTHER TENANT PAST DUE (Y OR N)";XD$
340 IFXD$="Y"THENGOTO170:IFXD$="N"THENGOTO350
350 LPRINT" ":LPRINT"TOTAL RENT DUE IS -";TAB(45);:LPRINTUSING"$###,####.##";BB
360 LPRINT"TOTAL INTEREST DUE IS -";TAB(45);:LPRINTUSING"$###,####.##";BC
370 LPRINT"TOTAL RENT PLUS INTEREST IS -";TAB(45);:LPRINTUSING"$###,####.##";BD
380 FOR I=1TO15:LPRINT" ":NEXT
390 END
```



Sample Run

```
THIS REPORT IS OF THE -THE MONTCLAIR APT.  COMPLEX
DATE OF THIS REPORT IS -6/15/79
-----------------------------------

NAME OF TENANT-    DATE DUE  RENT DUE    INTEREST     TOTAL      ACCUM.
-------------------------------------------------------------------------
GLASER DRUG CO.    3/1/79      1500     .75 %  45     1545       1545
GLASER DRUG CO.    4/1/79      1500     .75 %  33.75  1533.75    3078.75
GLASER DRUG CO.    5/1/79      1500     .75 %  22.5   1522.5     4601.25
GLASER DRUG CO.    6/1/79      1500     .75 %  11.25  1511.25    6112.5
-------------------------------------------------------------------------
TOTALS -                       6000             112.5            6112.5

JR. BAZAAR STORE   5/1/79      2450     1 %    49     2499       2499
JR. BAZAAR STORE   6/1/79      2450     1 %    24.5   2474.5     4973.5
-------------------------------------------------------------------------
TOTALS -                       4900             73.5             4973.5

VALIER, C.  NO. 101 5/1/79     675      1.5 %  20.25  695.25     695.25
VALIER, C.  NO. 101 6/1/79     675      1.5 %  10.13  685.13     1380.38
-------------------------------------------------------------------------
TOTALS -                       1350             30.38            1380.38

BECK, J.  NO. 503  6/1/79      450      1.5 %  6.75   456.75     456.75
-------------------------------------------------------------------------
TOTALS -                       450              6.75             456.75


TOTAL RENT DUE IS -                          $ 12,700.00
TOTAL INTEREST DUE IS -                      $    223.13
TOTAL RENT PLUS INTEREST IS -                $ 12,923.10
```

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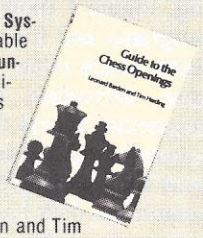

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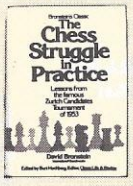

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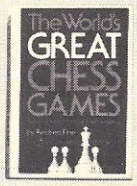

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SPECIAL OFFER

CIRCLE 5

An Interactive Retrieval Information System

BY DAVID E. TOLIVER
THE FRANKLIN INSTITUTE
RESEARCH LABORATORIES
PHILADELPHIA, PA

Do you have a mailing list file from which you want to selectively print the names and addresses of only those individuals who live in certain states, who do certain work and who are in a certain income bracket? Perhaps you have an inventory file from which you want quick reports on groups of products which have dropped below a certain level but aren't already on order. Or you may even have a recipe file from which you want to extract every recipe which uses mushrooms or onions, and burgundy wine, but not butter or cheese! If a variant of any of these search requirements is yours, then you need IRIS, the Interactive Retrieval Information System.

IRIS offers you the ability to (1) create sets of records based on keys derived from any or all data contained in the records; (2) review an alphabetic index of all such keys; (3) apply logical expressions to create sets of records that are subsets of the file with the specified characteristics; and (4) print out these subsets in a variety of formats. Strategies can be developed and changed interactively based on information that comes to light with each step in the search.

I initially developed IRIS on a DEC-System-10 with the intent to emulate Dialog, a large-scale bibliographic information retrieval system available through Lockheed Information Services in Palo Alto, CA. Dialog in turn is based on software developed by the RECON Project, an interactive search system produced by NASA. IRIS is written in the Dartmouth BASIC available on the DEC family of computers. The source code of the main search program occupies approximately 18K bytes while the source code of the three programs in the data base derivation subsystem are substantially smaller. The entire system should be adaptable to many of the larger personal computer systems currently available.

Overview of IRIS

IRIS consists of two subsystems: data base derivation and data base searching. Figure 1 shows a flowchart of the programs and files of the two subsystems which relate to each other. Data base derivation transforms a seed sequential access file into a *data base* consisting of four interrelated direct access files. A single program is used to search the data base. Figure 2 gives a schematic of the commands that can be issued in this program, together with the files which the commands use.

The seed sequential access file with which file derivation begins requires a specific format, described below. This file is the input file to DERIVE1, the first of three data base derivation programs. DERIVE1 outputs a direct access copy of the seed file and an intermediate sequential access file. The copy of the seed file contains the records eventually printed by the search system. The intermediate file, when sorted and processed by DERIVE2, becomes the searchable *inverted file system* of the data base. DERIVE3 prints the contents of the four direct access files with a

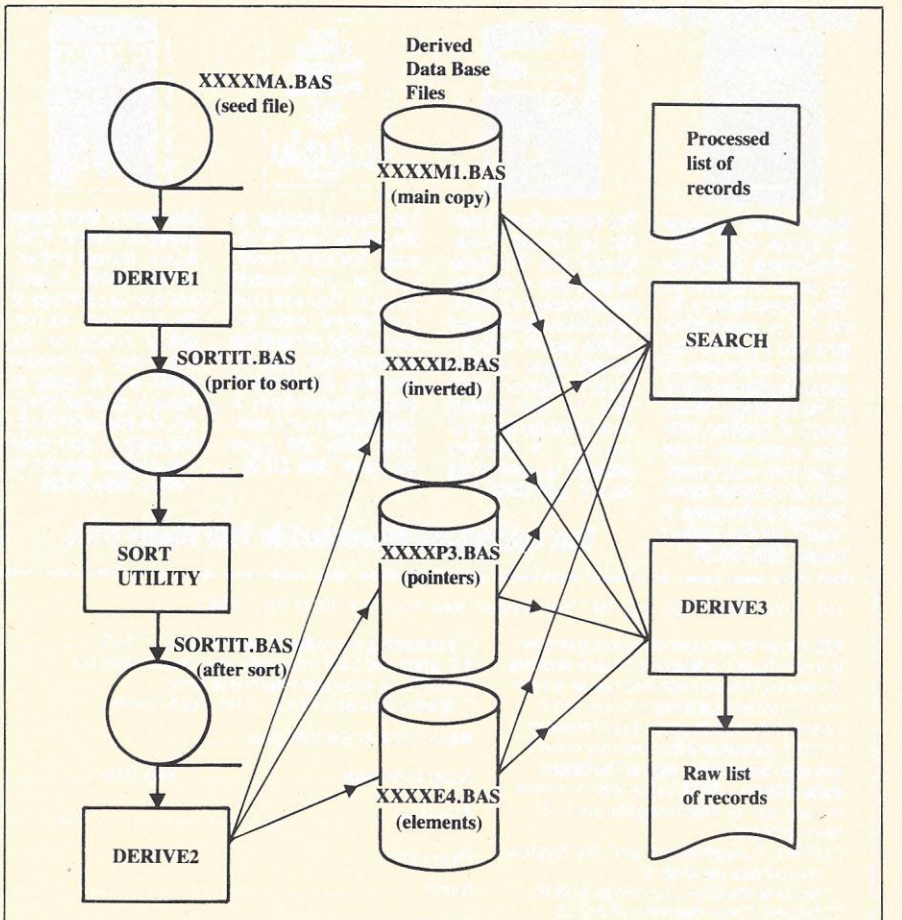


Figure 1 The data base: relationships among programs of both subsystems and the data base files. XXXX stands for the name of any data base.

minimum of special formatting. Derivation is described more fully below.

The SEARCH program requires the direct access files generated by the DERIVE programs, two files for maintaining data about sets created, and an optional file for capturing records as an alternative to printing. Eight functions can be performed by the SEARCH program: FILE, BEGIN, EXPAND, SELECT, COMBINE, DISPLAY SETS, PRINT and END. These functions are fully described below.

Seed File

Any number of data bases can be generated and searched with IRIS. Each begins with its own seed sequential access file which conforms to the fairly flexible standards described below. If you have not yet created your files, consider creating and maintaining them with your system's editor in the format required by IRIS. If you have already existing files which you want to search, you may either write preprocessing programs which accept your files as input and write IRIS-format seed files as output; or you may rewrite DERIVE1 to accept as input your files in their current format.

A few comments about IRIS files in the DECSystem-10 environment: Filenames consist of up to six characters, followed by a period, followed by a three-character extension. The seed filename and the four data base filenames for each data base all begin with the same user-chosen four letters, the *data base name*. The fifth letter of the filename represents the file's function in the data base. The sixth character is generally a number representing the channel assigned to the file in the search program. The filename extension is the DEC standard for BASIC files: ".BAS".

See Figure 3 for a short sample seed file which the derivation programs turned into the data base used for the sample search in Figure 4. The data base name is TEST. The seed file name is TESTMA.BAS. The subject matter approximates a personnel resources file.

Here are a few definitions relating to the programs. A *data element* is any string delimited by a space, comma, semicolon or line feed/carriage return, or surrounded by quotation marks. These units are read into BASIC string variables. A *field* is one or more contiguous data elements which are conceptually related. A *tag*, a data element which begins a field, indicates the concept involved in the field. Tags consist

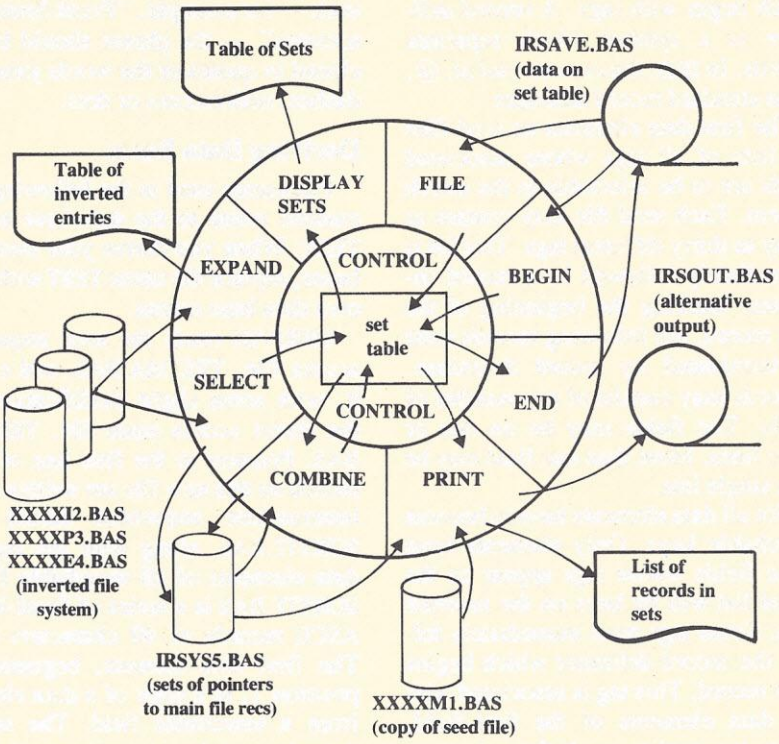


Figure 2 A schematic of the relationship among commands, files and outputs in the SEARCH program. XXXX stands for the name of any data base.

Figure 3

```
ENUM: NAME: STAT: SKIL: LOC: UNIV:
DEG: MAJ: CORP: FLD:
@
ENUM: 001
NAME: JOHNSON, P. R.
STAT: FULL-TIME
SKIL: CHEMISTRY  COMMUNICATIONS
LOC: NYC
UNIV: U-OF-PENNA
DEG: BS
MAJ: MATH
UYRS: 48-52
UNIV: DARTMOUTH
@
ENUM: 003
NAME: SCHMU, J. R.
STAT: FULL-TIME
SKIL: DATA-PROCESSING
LOC: PHILA
UNIV: MIT
DEG: BS
MAJ: COMPUTER-SCI
UYRS: 66-71
UNIV: U-OF-PENNA
DEG: NONE
MAJ: MATH
UYRS: 72-75
CORP: FIRL
FLD: DATA-PROCESSING
CYRS: 76-
@
ENUM: 004
NAME: RUBIN, A.
STAT: CONSULTANT
SKIL: DATA-PROCESSING SOCIOLOGY
LOC: NYC
UNIV: U-OF-PENNA
DEG: BA
MAJ: SOCIOLOGY
UYRS: 72-76
UNIV: COLUMBIA
DEG: MS
MAJ: LIB-SCI
UYRS: 76-78
CORP: FIRL
FLD: DATA-PROCESSING
CYRS: 77-
@
ENUM: 007
NAME: JAONOVICH, M. K.
STAT: FORMER-EMPLOYEE
SKIL: DATA-PROCESSING
LOC: PHILA
UNIV: U-OF-PENNA
DEG: MS
MAJ: COMPUTER-SCI
UYRS: 68-72
CORP: AUERBACH
FLD: PROGRAMMER
CYRS: 72-74
CORP: BIOSIS
FLD: DATA-PROCESING
CYRS: 74-76
CORP: FIRL
FLD: PROGRAMMER
CYRS: 76-
```

of from one to four characters immediately followed by a colon and a space. A *record* is a collection of fields, all of which begin with tags. A *record delimiter* is a symbol which separates records. In IRIS, the *commercial at*, @, is the standard record delimiter.

The first data elements on seed files are lists of all tags whose associated fields are to be selectable in the search system. Each seed file may contain as many as thirty different tags. This list is immediately followed by a record delimiter, marking the beginning of the first record. All following records must be terminated by record delimiters. Records may consist of any number of fields. The fields may be on one or more lines. More than one field may be on a single line.

Not all data elements have to become searchable keys. Only elements from those fields whose tags appear on the initial list will be keys on the inverted files. Some tags must immediately follow the record delimiter which begins each record. This tag is associated with the data elements of the first field. Every tag applies to all data elements which follow it in the field until the next tag is encountered. DERIVE1 identifies tags by their terminal colon. If a contiguous phrase should be searchable as such — for example, "Frank Smith Associates" — the phrase should be enclosed in quotes or the words joined by dashes, underscores or dots.

Deriving Data Bases

Filenames used in the following discussion relate to the data base named TEST. When you derive your own data bases, replace the name TEST with your own data base names.

DERIVE1 reads the seed sequential access file, TESTMA.BAS, and copies it, with some slight modifications, to the direct access main file, TESTM1.BAS. Pointers to the first line of each record on this new file are written to the intermediate sequential access file, SORTIT.BAS, along with the tag and data elements of all searchable fields. SORTIT.BAS is a series of fixed-length ASCII records of 40 characters each. The first data element, beginning in position 1, is a copy of a data element from a searchable field. The second data element, beginning in position 30, is the field's tag. The third data element, beginning in position 36, is the sequentially assigned pointer to the associated record in TESTM1.BAS.

Your computer system may provide as part of its system software a standard sort utility program. If it does not, you should be able to find a standard sort program for fixed-length sequential access files in the literature. Or you may want to write your own sort in either BASIC or in your system's assembly language. I recommend a Shell sort ("Relocatable Routines", *PC*, June 1978, and "More Shell Sort", *PC*, October 1978).

The intermediate file, SORTIT.BAS, must be sorted in ascending order on all 40 of its positions. Doing so alphabetizes all data elements and groups all precise matches together. Within a group of identical data elements, the tags are in alphabetical order. Within a group of identical data elements and tags, the pointers to records on TESTM1.BAS are in ascending order.

DERIVE2 accepts sorted SORTIT.BAS as its input file. Since SORTIT.BAS is temporary, you may delete it as soon as you complete DERIVE2. DERIVE2 outputs three direct access files

Figure 4

```
            FILE TEST IS ON-LINE

            SET   COUNT   DESCRIPTION
            ===   =====   ===========

?BEGIN

            SET   COUNT   DESCRIPTION
            ===   =====   ===========

?EXPAND DATA-PROCESSING

REF   DESCRIPTION                    CNT   RET
===   ===========                    ===   ===
 22    MAJ: COMPUTER-SCI              2     0
 23   STAT: CONSULTANT                2     0
 24   NAME: D.                        2     0
 25   UNIV: DARTMOUTH                 1     0
 26    FLD: DATA-PROCESING            1     0
    -       DATA-PROCESSING
 27    FLD: DATA-PROCESSING           3     0
 28    MAJ: DATA-PROCESSING           1     0
 29   SKIL: DATA-PROCESSING           4     0
 30   NAME: E.                        1     0
 31    MAJ: ENGLISH                   1     0
 32   CORP: FIRL                      5     0

?SELECT DATA-PROCESING
              1       1    DATA-PROCESING

?SELECT DATA-PROCESSING
              2       4    DATA-PROCESSING
```

```
?EXPAND PROGRAMMING

REF   DESCRIPTION                    CNT   RET
===   ===========                    ===   ===
 50    LOC: NYC                       3     0
 51   NAME: P.                        1     0
 52   STAT: PART-TIME                 1     0
 53    LOC: PHILA                     3     0
 54    FLD: PROGRAMMER                1     0
    -       PROGRAMMING
 55   NAME: R.                        2     0
 56   NAME: RUBIN                     1     0
 57   NAME: SCHMU                     1     0
 58   CORP: SKF                       2     0
 59   NAME: SMITH                     2     0
 60   CORP: SMITH-ASSOCIATES          1     0

?SELECT #54
              3       1    #54: FLD:PROGRAMMER

?COMBINE 1 OR 2 OR 3
              4       5    1 OR 2 OR 3

?SELECT CORP: FIRL
              5       5    CORP: FIRL

?SELECT CORP: SKF
              6       2    CORP: SKF

?COMBINE 5 OR 6
              7       7    5 OR 6

?SELECT U-OF-PENNA
              8       6    U-OF-PENNA

?SELECT UNIV: COLUMBIA
              9       1    UNIV: COLUMBIA
```

which reorganize for rapid access the information found on SORTIT.BAS. The first of these three files, TESTI2.-BAS, contains a set of five values for each inverted file entry. Only the first three values are used in this version of IRIS. The first value is the pointer to the term and tag as they are alphabetically ordered on the alphanumeric element file, TESTE4.BAS. The second value is the count of records which contain this tag and term. The third value is the pointer to the place on the pointer file, TESTP3.BAS, where a set of pointers begins. This set points out all records on TESTM1.BAS which contain the tag and term of the associated inverted file entry.

DERIVE3 dumps all four direct access files on your display. This dump is useful for testing and debugging modifications to IRIS. I included it here in case you want to change IRIS for your own applications. You can validate changes to both the file derivation programs and the search program by tracing through the relationships printed by the DERIVE3 program. DERIVE3 will request the name of the data base to be dumped.

Operating the derivation subsystem is quite straightforward. When executed, DERIVE1 will request the data base name. Enter the four character name — for example, "TEST". DERIVE1 will then run to completion with no further intervention. Then sort SORTIT.BAS on all 40 of its positions. If the sort's output file requires another temporary name, rename it SORTIT.BAS. Then execute DERIVE2. After asking for the four-character data base name, the program will run to completion with no further intervention. At this point, you're ready to search the data base with the SEARCH program.

Searching Data Bases

You may issue commands to the IRIS SEARCH programs whenever the BASIC INPUT cue, the question mark, appears. As with all user input, you must end commands with a carriage return. If a command contains a syntax error, SEARCH responds with an error message followed by the question mark cue for another command.

Figure 4 shows a sample search on the data base derived from the initial file of Figure 3. Figure 5 gives a step-by-step description of what is happening in the search. Figure 6 summarizes the names and functions of the IRIS commands.

SEARCH uses all four of the derived direct access files as well as three other files of its own. Two of the files accumulate and store data about the sets created in the search. IRSAVE.BAS, a sequential access file, stores information about the sets' arguments, record counts and pointers to IRSYS5.BAS, which in turn stores pointers to records on XXXXM1.BAS, where XXXX is the currently searched data base.

IRSAVE.BAS is read into the set table at the beginning of the program and written from the set table after END is issued. Pointers stored on IRSYS5.BAS are in sets as created by the SELECT and COMBINE commands. This file is used throughout the search.

One more sequential access file, IRSOUT.BAS, serves as an alternative to printing records at the terminal. It may be useful in selectively transmitting subfiles.

Now let's look at the syntax and function of each of the commands in more detail:

```
?S YALE
            10        0    YALE

?COMBINE 8 OR 9
            11        6    8 OR 9

?COMBINE 4 AND 7 AND 11
            12        3    4 AND 7 AND 11

?DS

      SET   COUNT   DESCRIPTION
      ===   =====   ===========
       1        1   DATA-PROCESING
       2        4   DATA-PROCESSING
       3        1   #54: FLD:PROGRAMMER
       4        5   1 OR 2 OR 3
       5        5   CORP: FIRL
       6        2   CORP: SKF
       7        7   5 OR 6
       8        6   U-OF-PENNA
       9        1   UNIV: COLUMBIA
      10        0   YALE
      11        6   8 OR 9
      12        3   4 AND 7 AND 11

?C (1OR2OR3) AND (5 OR 6) AND (8 OR 9)
            13        3    (1OR2OR3)
                           AND (5 OR 6)
                           AND (8 OR 9)

?PRINT 12/2/1-3

            ACCN = 53

ENUM:  003
NAME:  SCHMU J. R.
STAT:  FULL-TIME
SKIL:  DATA-PROCESSING
LOC:   PHILA
UNIV:  MIT
DEG:   BS
MAJ:   COMPUTER-SCI
UYRS:  66-71
UNIV:  U-OF-PENNA
DEG:   NONE
MAJ:   MATH
UYRS:  72-75
CORP:  FIRL
FLD:   DATA-PROCESSING
CYRS:  76-

            ACCN = 70
ENUM:  004
NAME:  RUBIN A.
STAT:  CONSULTANT
SKIL:  DATA-PROCESSING SOCIOLOGY
LOC:   NYC
UNIV:  U-OF-PENNA
DEG:   BA
MAJ:   SOCIOLOGY
UYRS:  72-76
UNIV:  COLUMBIA
DEG:   MS
MAJ:   LIB-SCI
UYRS:  76-78
CORP:  FIRL
FLD:   DATA-PROCESSING
CYRS:  77-

            ACCN = 117
ENUM:  007
NAME:  JAONOVICH M. K.
STAT:  FORMER-EMPLOYEE
SKIL:  DATA-PROCESSING
LOC:   PHILA
UNIV:  U-OF-PENNA
DEG:   MS
MAJ:   COMPUTER-SCI
UYRS:  68-72
CORP:  AUERBACH
FLD:   PROGRAMMER
CYRS:  72-74
CORP:  BIOSIS
FLD:   DATA-PROCESING
CYRS:  74-76
CORP:  FIRL
FLD:   PROGRAMMER
CYRS:  76-

?PRINT 13/1/1-3
53
70
117

?END

SEARCH SETS SAVED


TIME:  13.22 SECS.

READY
```

FILE command syntax:
FILE (data base name) (CR)

Here (data base name) is the four-character name assigned to each system of files created by the DERIVE subsystem. This command assigns the files of the designated data base to the search system and clears the set table so that set numbers begin again with "1". Acceptable data base names are verified by the program's only internal data, found on line 190 of the listing. The first data element on this line is the number of data bases which have been derived from your seed files. The remaining data elements are all four-character data base names. You should alter line 190 to reflect the number and names of the data bases in your IRIS version.

BEGIN command syntax:
BEGIN (CR)

This command takes no argument. All it does is clear the set table so that set numbers begin again with "1". The SEARCH system allows as many as 99 user-created sets, so you must periodically use either BEGIN or FILE. I recommend you issue BEGIN at the beginning of every distinct search.

EXPAND command syntax:
EXPAND (tag):(term)(CR) *or*
EXPAND (term)(CR) *or*
EXPAND #(reference number)(CR)

Here, (tag) is associated with an inverted index element, (term) is any string, not necessarily on the inverted file, and (reference number) is a fixed sequential number for each inverted file entry. This number probably will change with each derivation. The command verb, EXPAND, may be abbreviated to simply "E". The search program responds to this command with a table of approximately ten inverted file entries surrounding the given term and alphabetically ordered by term. The table also gives the reference number and the number of postings for each term.

SELECT command syntax:
SELECT (tag):(term)(CR) *or*
SELECT (term)(CR) *or*
SELECT #(reference number)(CR)

This command's arguments are the same as defined for EXPAND. The command verb SELECT may be abbreviated to simply "S". The search program responds with a sequentially assigned set number, the number of records in the set and a recapitulation of the argument. The set may be thought of as a subfile of all the records in the data base which contain the specified term or data element in a searchable field. If no tag is specified, all searchable fields containing the term contribute to the set. If a tag is specified, only the terms in the field indicated by the tag contribute to the set. If a reference number is specified, the set consists of all records containing the term as tagged in the corresponding line of an EXPAND table.

COMBINE command syntax:
COMBINE (logical expression)(CR)

Here, (logical expression) is a Boolean expression involving set numbers of already existing sets, the logical operators AND, OR and NOT, and validly nested left and right parentheses. Spaces are freely allowed but are not required throughout the expression. The search system response looks

Figure 5 Step-by-step description of sample search.

The search objective is to print records on all personnel who have worked in DATA-PROCESSING *or* PROGRAMMING, *and* who have attended the University of Pennsylvania, Columbia *or* Yale.

BEGIN - This insures that set numbering begins with "1".

EXPAND DATA-PROCESSING - Inverted file entries alphabetically surrounding DATA-PROCESSING are printed.

SELECT DATA-PROCESSING - The misspelled entry is made into set 1.

SELECT DATA-PROCESSING - Entries with three different tags but the same data element, DATA-PROCESSING, are formed into set 2, which refers to four records in the file.

EXPAND PROGRAMMING - Inverted file entries around PROGRAMMING are reviewed.

SELECT #54 - This selects PROGRAMMER by its cur rent reference number.

COMBINE 1 OR 2 OR 3 - Set 4 consists of all records containing DATA-PROCESSING (including to the CORP: tag.

SELECT CORP: SKF

COMBINE 5 OR 6 - Set 7 consists of 7 records on individuals who have worked or are working for FIRL or SKF.

SELECT U-OF-PENNA - An EXPAND may have been useful to pick up variants.

SELECT UNIV: COLUMBIA

S YALE - Here the SELECT verb is abbreviated to simply 5.

COMBINE 8 OR 9 - Set 11 reflects 6 people who attended either the University of Pennsylvania or Columbia.

COMBINE 4 AND 7 AND 11 - Set 12 reflects 3 people who fulfill the objective of our search: all have worked in data processing and have association with the specified corporations and universities.

DS - All sets created thus far are reviewed.

C (1 OR 2 OR 3) AND (5 OR 6) AND (8 OR 9) - This command was issued to demonstrate an alternative logical expression. Set 13 reflects exactly the same three records as set 12. The logical combinations were done in one step for set 13 while they were done in four steps for set 12.

PRINT 12/2/1-3 - All three records in set 12 are printed misspellings!) or PROGRAMMER.

SELECT CORP: FIRL - Selection of FIRL is restricted out in full by format 2. ACCN = the internal access number or pointer. Compare the records printed here with the seed file records for the same people. A few minor differences should be evident.

PRINT 13/1/1-3 - The internal access numbers of set 13 only are printed out by format 1. Since these numbers are the same as those printed with the records of set 12, the results of their creating COMBINE are shown to be the same.

END - The set table is saved for the next session and this session is terminated.

much like the result of a SELECT command, with the next set number, the number of records and a recapitulation of the COMBINE argument. The set contains pointers to all records with the characteristics specified by the logical expression. Sets created previously by COMBINE commands can be used in the logical expression as well as sets created previously by the SELECT command. The command verb COMBINE may be abbreviated to simply "C"

DISPLAY SETS command syntax:
DISPLAY SETS (CR) *or*
DS (CR)

This command takes no argument. The search system responds with a recapitulation of all set data using the same format as the single-line responses to COMBINE and SELECT commands. This command is useful for CRT terminals or when a lot of printing and expanding was done between the creation of sets. A DISPLAY SETS table just prior to issuing a COMBINE command helps you choose the right sets for the command's argument.

PRINT command syntax:
PRINT (set number)/(format)/(initial record)-(final record)(CR)

Here, (set number) is the number of a created set whose records you want to view, (format) is a code for how much and what part of the record you want printed, (initial record) is the record in the set with which printing is to begin, and (final record) is the record in the set with which printing is to terminate. The -(final record) is optional. If omitted, only the (initial record) will be printed. PRINT may be abbreviated to "P". Spaces are not allowed in the argument after the set number. Format codes can be altered to suit your application. The present version of the SEARCH program uses the following codes: 1 = list internal record pointers (access numbers) only; 2 = list records in full; 3 = list record pointers and the first field of each record; 9 = write full records to the sequential access file IRSOUT.BAS. These records are written to IRSOUT.BAS in essentially the same format as they appear on the seed sequential access file.

END command syntax:
END (CR)

The END command takes no argument. It writes the set table to IRSAVE.BAS, where the set data is saved for the next search session. Program control then transfers to the BASIC monitor.

Two features of the SEARCH program presented in Figure 2 deserve discussion: control and the set table. The Control part of the program is shared in common by all of the search commands. It contains the program's only BASIC INPUT instruction, which accepts all search commands. It determines the command verb and passes the command argument to the appropriate sector for further processing.

The set table consists of internal lists with variable names S$(100), S1(200) and S2(200). These lists are loaded by Control at the beginning of the program by reading the contents of IRSAVE.BAS into them. S$ contains the set creating arguments, S1 contains the count of records in each set and S2 contains the pointers to the beginning of each set of pointers on the file IRSYS5.BAS. Every time a new set is created, these elements are added to this table. The table is cleared by the BEGIN and FILE commands and written out after the END command. □

FILE - Attach a data base and clear the set table.
BEGIN - Clear the set table for the current data base.
EXPAND - Review approximately ten lines of the alphabetic inverted file key index.
SELECT - Create a set of pointers to main file records based upon an inverted file key entry.
COMBINE - Create a set of pointers to main records based upon a logical expression involving existing sets.
DISPLAY SETS - Review all sets created by SELECT and COMBINE.
PRINT - Display at the terminal or write to a file some or all records or parts of records in sets created.
END - Terminate the session and save the set table.

Figure 6 The name and functions of all IRIS commands.

Program Listing 1A: Derive 1

```
00010   DERIV1.bas reads the seed sequential
00020   access file and copies it to a direct
00030   access file named XXXXM1.bas, where
00040   XXXX is the data base name. This program
00050   also creates SORTIT.bas,
        an intermediate file
00060   dim T$(31)
00070   print "D. B. NAME = ";
00080   input D$
00090   file :1, D$+"M1$39"
00100   file #2, D$+"MA.BAS"
00110   file #3, "SORTIT"
00120   scratch #3
00130   for T = 1 to 31
00140   if end #2 goto 650
00150   INPUT #2, T$(T)
00160   IF T$(T) = "@" GOTO 240
00170   IF LEN(T$(T)) > 5 GOTO 720
00180   IF RIGHT$(T$(T),1) <> ":" GOTO 690
00190   WRITE :1, T$(T)
00200           NEXT T
00210   '
00220   A$ = T9$ + SPACE$(6-LEN(T9$)) + A$
00230   PRINT :1, A$
00240   WRITE :1, "@"
00250   P1 = LOC (1)
00260   IF END #2, GOTO 740
00270   INPUT #2, S$
00280   IF RIGHT$(S$,1) = ":" GOTO 450
00290   GOTO 670
```

Derive 1 continued

```
00300   A$ = ""
00310   IF END #2, GOTO 740
00320   INPUT #2, S$
00330   IF S$ ="@" GOTO 210
00340   IF RIGHT$(S$,1) = ":" GOTO 430
00350   L = LEN (A$) + LEN (S$)
00360   IF L > 31 GOTO 390
00370   A$ = A$ + " " + S$
00380   GOTO 310
00390   A$ = T9$ + SPACE$(6-LEN(T9$)) + A$
00400   PRINT :1, A$
00410   A$ = " " + S$
00420   GOTO 310
00430   A$ = T9$ + SPACE$(6-LEN(T9$)) + A$
00440   PRINT :1, A$
00450   T9$ = S$  SEARCH FOR SEARCHABLE TAGS
00460   FOR X = 1 TO T-1
00470           IF S$ = T$(X) GOTO 500
00480           NEXT X
00490   GOTO 300
00500   A$ = ""
00510   IF END #2, GOTO 740
00520   INPUT #2, S$ SEARCHABLE FIELDS
00530   IF S$ = "@" GOTO 210
00540   IF RIGHT$(S$,1) = ":" GOTO 430
00550   PRINT #3, USING 560, S$, T9$, P1
00560   :'LLLLLLLLLLLLLLLLLLLLLLLLLL 'LLLL #
00570   L = LEN (A$) + LEN (S$)
00580   IF L > 31 GOTO 610
00590   A$ = A$ + " " + S$
00600   GOTO 510
00610   A$ = T9$ + SPACE$(6-LEN(T9$)) + A$
00620   PRINT :1, A$
00630   A$ = " " + S$
00640   GOTO 510
00650   PRINT "ERROR: No record mark '@'
        was encountered."
00660   STOP
00670   PRINT 'ERROR: A record does not begin
        with a tagged field."
00680   STOP
00690   PRINT "ERROR: Tag list either has entry
        not ending with ':' "
00700   PRINT or first record is not marked by '@'."
00710   STOP
00720   PRINT "ERROR: A tag in the list is
        longer than 5 characters."
00730   STOP
00740   IF S$ = "@" GOTO 760
00750   PRINT "ERROR: File is not terminated
        with record mark '@'."
00760   END
```

Program Listing 1C: Derive 3

```
00010   DERIV3.bas dumps all 4 direct access files
00020   PRINT "D. B. NAME =";
00030   INPUT D$
00040 FILE #9, "REPORT.LST"
00050 MARGIN #9, 132
00060 SCRATCH #9
00070 PRINT #9, D$; "M1$39 OUTPUT"
00080 PRINT #9
00090 PRINT #9
00100 FILE :1, D$+"M1$39"
00110 X = 1
00120 IF END :1, GOTO 170
00130 READ :1, S$
00140 PRINT #9, X,S$
00150 X = X+1
00160 GO TO 120
00170 X = 1
00180 PRINT #9
00190 FILE : 1, D$+"I2%"
00200 PRINT #9, D$; "I2%  OUTPUT"
00210 PRINT #9
00220 PRINT #9
00230 PRINT #9, X,,
00240 FOR Y = 1 TO 10
00250   IF END :1, GOTO 330
00260   READ :1, S
00270   PRINT #9, S;
00280   NEXT Y
00290 X = X+10
00300 PRINT #9
00310 PRINT #9
00320 GOTO 230
00330 X = 1
00340 FILE :1, D$+"P3%"
00350 PRINT #9
00360 PRINT #9
00370 PRINT #9, D$; "P3%  OUTPUT"
00380 PRINT #9
00390 PRINT #9
00400 PRINT #9, X,,
00410 FOR Y = 1 TO 10
00420   IF END :1, GOTO 500
00430   READ :1, S
00440   PRINT #9, S;
00450   NEXT Y
00460 X = X+10
00470 PRINT #9
00480 PRINT #9
00490 GOTO 400
00500 PRINT #9
00510 PRINT #9
00520 PRINT #9
00530 X = 1
00540 FILE :1, D$+"E4$"
00550 PRINT #9, D$; "E4$  OUTPUT"
00560 PRINT #9
00570 PRINT #9
00580 IF END :1, GOTO 630
00590 READ :1, S$
00600 PRINT #9,, X, S$
00610 X = X+ 1
00620 GOTO 580
00630 PRINT #9
00640 PRINT #9
00650 END
```

Program Listing 1B: Derive 2

```
00010 DERIV2.bas reads SORTIT.bas,
      the intermediate
00020 sequential access file
      after having been
00030 sorted. It writes three
      direct access files
00040 which form the inverted file system.
      These
00050 files are XXXXI2.bas,
      the inverted file
00060 coordinator, XXXXP3.bas,
      the sets of pointers
00070 to main files, and XXXXE4.bas,
      the alphabetic
00080 data element file.  XXXX may be
00090  any data base name.
00100   print "D. B. Name = ";
00110   input D$
00120   file #1, "SORTIT"
00130   file :2, D$+"I2%"
00140   file :3, D$+"P3%"
00150   file :4, D$+"E4$"
00160   if lof (3) = 0 goto 220
00170   print "ERROR: ";D$;"I2.BAS%
        was not deleted."
00180   print "Delete search system random files
        from monitor level."
00190   print "Then begin process with program
        DERIVE1, sort, DERIVE2."
00200   stop
00210   Initial input from sorted index file
00220   '
00230   if end #1, goto 470
00240   input #1, S$, T$, P1$
00250   S1$ = S$ + T$              'string and tag
00260   A$ = S1$ + P1$             'entire string
00270   P1 = val (P1$)
00280   P3 = loc (3)
00290   print :3, P1
00300   C = 1
00310   '
00320   Second input for compare with prior input
00330   '
00340   A1$ = A$
00350   if end #1, goto 470
00360   input #1, S2$, T2$, P1$
00370   S3$ = S2$+T2$    'string and tag 2
00380   A$ = S3$ + P1$   'entire string 2
00390   P1 = val (P1$)
00400   if S3$ <> S1$ goto 470
00410   if A$ = A1$ goto 350
00420   print :3, P1
00430   C = C + 1
00440   goto 340
00450   '
00460   Print index entry on file :3, :4, :8
00470   print :2, loc(4),C, P3, 0, 0
00480   IF LEN(S$)<29 GOTO 500
00490   S$ = LEFT$(S$,28)
00500   S$ = S$ + SPACE$(29 - LEN(S$)) + T$
00510   PRINT :4, S$
00520   if end #1, goto 570
00530   S1$ = S3$
00540   S$ = S2$
00550   T$ = T2$
00560   goto 280
00570   end
```

Program Listing 2: Search

```
00010   DIM A(1000), B(1000)
00020   DIM T(20)
00030   DIM S$(100), S1(200), S2(200)
           'Set info: text, count, pointer to :5
00040   REM FILE :5 HOLDS NUMERIC POINTERS TO
        :1 IN SETS
00050   FILE :5, "IRSYS5%"
00060   FILE #8, "IRSAVE"
00070   FILE # 9, "IRSOUT"
00080   SCRATCH # 9
00090   QUOTE # 9
00100   IF END #8, GOTO 950
00110   READ #8, D$, T9
00120   RESTORE
00130   READ X
00140   FOR Y = 1 TO X
00150      READ J$
00160      IF J$ = D$ GOTO 200
00170      NEXT Y
00180   GOTO 940
00190   DATA 5,SISO,FIRL,GSLS,TEST,INDX
00200   FILE :1, D$+"M1$39"
        'MAIN FILE
00210   FILE :2, D$+"I2%"
        INVERTED FILE W/ POINTER TO :4,
00220   REM
        COUNT, AND POINTER TO FIRST ON :3
00230   FILE :3, D$+"P3%"
        POINTER  FILE TO :1 ENTRIES
00240   FILE :4, D$+"E4$"
        ALPHA ELEMENTS TO BE SEARCHED
00250   PRINT, "FILE "; D$; " IS ON-LINE"
00260   IF END #8, GOTO 310
00270   READ #8, S
00280   FOR X = 1 TO S
00290            READ #8, S$(X), S1(X), S2(X)
00300            NEXT X
00310   PRINT
00320   PRINT, "SET   COUNT   DESCRIPTION"
00330   PRINT, "===   =====   ==========="
00340   '
00350   PRINT    'STANDARD RETURN POINT
00360   INPUT I$
00370   L = LEN (I$)
00380   IF I$ <> " " GOTO 410
00390   PRINT "ERR1: TOO MUCH SPACE"
00400   GOTO 350
00410      IF LEFT$(I$,7) = "COMBINE" GOTO 580
00420      IF LEFT$(I$,7) = "DISPLAY" GOTO 580
00430      IF LEFT$(I$,6) = "SELECT" GOTO 600
00440      IF LEFT$(I$,6) = "EXPAND" GOTO 600
00450      IF LEFT$(I$,5) = "PRINT" GOTO 620
00460      IF LEFT$(I$,5) = "BEGIN" GOTO 980
00470      IF LEFT$(I$,4) = "FILE" GOTO 640
00480      IF LEFT$(I$,3) = "END" GOTO 1040
00490      IF LEFT$(I$,2) = "DS" GOTO 5240
00500      IF LEFT$(I$,1) = "S" GOTO 660
00510      IF LEFT$(I$,1) = "C" GOTO 660
00520      IF LEFT$(I$,1) = "E" GOTO 660
00530      IF LEFT$(I$,1) = "D" GOTO 660
00540      IF LEFT$(I$,1) = "P" GOTO 660
00550      IF LEFT$(I$,1) = "F" GOTO 660
00560   PRINT "ERR2: INVALID COMMAND"
00570   GOTO 350
00580      Y = 8
00590   GOTO 670
00600      Y = 7
```

Program Listing 2 continued

```
00610   GOTO 670
00620      Y = 6
00630   GOTO 670
00640      Y = 5
00650   GOTO 670
00660      Y = 2
00670   FOR Z = Y TO L
00680      IF MID$(I$,Z,1) <> " " GOTO 710
00690      NEXT Z
00700   GOTO 390
00710   T$ = M$ = " "
00720   A = 0
00730      C$ = LEFT$(I$,1)
00740      J$ = MID$(I$,Z)
00750   I$ = J$
00760   IF LEFT$(J$,1) = "(" GOTO 860
00770   X = INSTR (J$, ":")
00780   IF X = 0 GOTO 860
00790   T$ = LEFT$(J$,X)
        'T$ IS TAG FOR SEARCH
00800   J$ = MID$(J$,X+1)
        'J$ IS ELEMENT FOR SEARCH
00810   FOR X = 1 TO LEN(J$)
00820           IF MID$(J$,X,1) <> " " GOTO 850
00830           NEXT X
00840   GOTO 390
00850   J$ = MID$(J$,X)
00860   IF C$ = "F" GOTO 970
00870   IF C$ = "S" GOTO 1140
00880   IF C$ = "C" GOTO 2170
00890   IF C$ = "E" GOTO 4580
00900   IF C$ = "D" GOTO 5190
00910   IF C$ = "P" GOTO 5320
00920   GOTO 560
00930   REM *     "BEGIN" & "END" ROUTINES     *
00940   PRINT "ERR3: INVALID FILE NAME"
00950   print "FILE = ";
00960   input J$
00970   D$ = J$
00980   MAT S1 = ZER
00990   MAT S2 = ZER
01000   S = 0
01010   T9 = 1
01020   IF LEFT$(I$,5) = "BEGIN" GOTO 310
01030   goto 120
01040   SCRATCH #8
01050   QUOTE #8
01060   WRITE #8, D$, T9, S
01070   FOR X = 1 TO S
01080           WRITE #8, S$(X), S1(X), S2(X)
01090           NEXT X
01100   PRINT
01110   PRINT "SEARCH SETS SAVED"
01120   PRINT
01130   STOP
01140   REM *       "SELECT" SEGMENT       *
01150   SET :5, T9
01160   IF LEFT$(I$,1) = "#" GOTO 1750
01170   IF T$ = " " GOTO 1220
01180   GO SUB 6510
01190   IF Q9 = 0 GOTO 2070
01200   SET :2, LOC(4)*5 - 8
01210   GOTO 2000
01220   REM *     PROCESS TAG-LESS OPERAND     *
01230   GO SUB 6510
01240   SET :2, P2*5 - 4
01250   set :4, P2
01260   IF END :4, GOTO 2070
01270   READ :4, K$
01280   IF LEFT$(J1$,28)<>LEFT$(K$,28) GOTO 2070
01290   IF END :2, GOTO 2070
01300   READ :2, Z, C, P3, X, Y
01310   SET :3, P3
01320   FOR A = 1 TO C
01330           READ :3, A(A)
01340           NEXT A
01350   IF END :4, GOTO 1710
01360   READ :4, K$
01370   IF LEFT$(J1$,28) <> LEFT$(K$,28)
        GOTO 1710
01380   IF END :2, GOTO 1710
01390   READ :2, Z, C, P3, X, Y
01400   B = X = Y = 1
01410   IF X > C GOTO 1580
01420   READ :3, B(B)
01430   IF Y > A GOTO 1630
01440   IF A(Y) = B(B) GOTO 1490
01450   IF A(Y) < B(B) GOTO 1530
01460   B = B + 1
01470   X = X + 1
01480   GOTO 1410
01490   B = B + 1
01500   X = X + 1
01510   Y = Y + 1
01520   GOTO 1410
01530   B(B+1) = B(B)
01540   B(B) = A(Y)
01550   B = B + 1
01560   Y = Y + 1
01570   GOTO 1430
01580   FOR X = Y TO A
01590           B(B) = A(X)
01600           B = B + 1
01610           NEXT X
01620   GOTO 1670
01630   FOR Y = X TO C
01640           READ :3, B(B)
01650           B = B + 1
01660           NEXT Y
01670   FOR A = 1 TO B-1
01680           A(A) = B(A)
01690           NEXT A
01700   GOTO 1350
01710   FOR X = 1 TO A
01720           WRITE :5, A(X)
01730           NEXT X
01740   GOTO 2070
01750   REM *  SELECT POINTER FROM EXP TABLE  *
01760   LET L = LEN(I$)
01770   FOR X = 2 TO L
01780     IF MID$(I$,X,1) <> " " GOTO 1820
01790     NEXT X
01800   PRINT "ERR1: TOO MUCH SPACE"
01810   GOTO 350
01820   FOR Y = X TO L
01830      C$ = MID$(I$,Y,1)
01840     IF C$ < "0", GOTO 1920
01850     IF C$ > "9", GOTO 1920
01860     NEXT Y
01870   R = VAL (MID$(I$,X))
01880   IF R = 0 GOTO 1900
01890   IF R <= LOF(2)/5 GOTO 1940
01900   PRINT "ERR4: INVALID ENTRY"
01910   GOTO 350
```

```
01920   PRINT "ERR5: INVALID CHARACTER"
01930   GOTO 350
01940
01950   SET :2, R*5-3
01960   SET :4, R
01970   READ :4, K$
01980   K$ = MID$(K$,30) + LEFT$(K$,26-L)
01990   I$ = I$+": "+K$
02000   READ :2, C, P3
02010      SET :3, P3
02020   FOR X = 1 TO C
02030      READ :3, P1
02040      WRITE :5, P1
02050      NEXT X
02060   A = C
02070   REM *     DISPLAY SET DATA     *
02080   S = S + 1
02090   S$(S) = I$
02100   S1(S) = A
02110   S2(S) = T9
02120   T9 = LOC(5)
02130   PRINT USING 2140, S, A, I$
02140   :              ##     ###     'EEEEE
02150   IF B2 = 0 GOTO 350
02160   GOTO 2560
02170   REM *       "COMBINE" SEGMENT       *
02180   MAT T = ZER
02190   J$ = "(" + J$ + ")%"
02200   R = 100
02210   T = 0
02220   T(T) = 900
02230   IF J$ = "%" GOTO 4380
02240   R$ = LEFT$(J$,1)
02250   J$ = MID$(J$,2)
02260   T = T + 1
02270   IF R$ = " " GOTO 2520
02280   IF R$ = "(" GOTO 2550
02290   IF R$ = "A" GOTO 2580
02300   IF R$ = "N" GOTO 2650
02310   IF R$ = "O" GOTO 2710
02320   IF R$ = ")" GOTO 2790
02330   IF R$ < "0" GOTO 4480
02340   IF R$ > "9" GOTO 4480
02350   EVALUATE SET NUMBER
02360   IF T(T-1) < 100 GOTO 4500
02370   R1$ = R$
02380   R$ = LEFT$ (J$,1)
02390   J$ = MID$(J$,2)
02400   IF R$ < "0" GOTO 2480
02410   IF R$ > "9" GOTO 2480
02420   R1$ = R1$ + R$
02430   T(T) = VAL (R1$)
02440   if T(T) < 1 goto 4500
02450   IF T(T) > S GOTO 4500
02460   GOTO 2230
02470   COMPLETE SET # EVALUATION
02480   T(T) = VAL (R1$)
02490   IF T(T) > S GOTO 4500
02500   GOTO 2260
02510   IGNORE ALL BLANKS IN ARGUMENTS
02520   T = T - 1
02530   GOTO 2230
02540   EVALUATION OF LEFT PARENTHESIS
02550   IF T(T-1) < 200 GOTO 4520
02560   T(T) = 400
02570   GOTO 2230
02580   EVALUATE "AND" OPERATOR
02590   IF LEN(J$) < 4 GOTO 4540
02600   IF LEFT$(J$,2) <> "ND" GOTO 4540
02610   J$ = MID$(J$,3)
02620   T(T) = 310
02630   GOTO 2760
02640   EVALUATE "NOT" OPERATOR
02650   IF LEN (J$) < 4 GOTO 4540
02660   IF LEFT$ (J$,2) <> "OT" GOTO 4540
02670   J$ = MID$(J$,3)
02680   T(T) = 330
02690   GOTO 2760
02700   EVALUATE "OR" OPERATOR
02710   IF LEN (J$) < 3 GOTO 4540
02720   IF LEFT$(J$,1) <> "R" GOTO 4540
02730   J$ = MID$(J$,2)
02740   T(T) = 320
02750   WIND UP OPERATORS
02760   IF T(T-1) > 199 GOTO 4520
02770   GOTO 2230
02780   EVALUATION OF SCOPE IN EXPRESSION
02790   IF T(T-1) > 199 GOTO 4520
02800   IF T(T-2) <> 400 GOTO 2840
02810   T(T-2) = T(T-1)
02820   T = T-2
02830   GOTO 2230
02840   IF INT ( T(T-2)/100) <> 3 GOTO 4520
02850   SEARCH BACKWARD FOR "NOT" OP.
02860   N = T-2
02870   IF N < 2 GOTO 3330
02880           IF T(N) = 330 GOTO 2910
02890           IF T(N) = 400 GOTO 3330
02900           GOTO 3300
02910           R = R+1
02920           SET :5, S2(T(N-1))
02930           A = S1(T(N-1))
02940           FOR X = 1 TO A
02950                   READ :5, A(X)
02960                   NEXT X
02970           SET :5, S2(T(N+1))
02980           C = S1(T(N+1))
02990           B=X=Y=1
03000           IF X > C GOTO 3140
03010           READ :5, P
03020           IF Y > A GOTO 3180
03030           IF A(Y) = P GOTO 3110
03040           IF A(Y) < P GOTO 3070
03050           X = X+1
03060           GOTO 3000
03070           B(B) = A(Y)
03080           Y = Y + 1
03090           B = B + 1
03100           GOTO 3020
03110           X = X + 1
03120           Y = Y + 1
03130           GOTO 3000
03140           FOR X = Y TO A
03150                   B(B) = A(X)
03160                   B = B + 1
03170                   NEXT X
03180           S2(R) = T9
03190           SET :5, T9
03200           FOR X = 1 TO B-1
03210                   WRITE :5, B(X)
03220                   NEXT X
03230           T9 = LOC(5)
03240           T(N-1) = R
03250           S1(R) = B-1
03260           FOR X = N + 2 TO T
03270                   T(X-2) = T(X)
03280                   NEXT X
03290           T = T-2
```

Program Listing 2 continued

```
03300   N = N-2
03310   GOTO 2870
03320   SEARCH FORWARD FOR "AND" OP.
03330   M = N + 2
03340   IF M >= T GOTO 3750
03350   IF T(M) = 310 GOTO 3380
03360   M = M+2
03370   GOTO 3340
03380           R = R + 1
03390           SET :5, S2(T(M-1))
03400           A = S1(T(M-1))
03410           FOR X = 1 TO A
03420                   READ :5, A(X)
03430                   NEXT X
03440           SET :5, S2(T(M+1))
03450           C = S1(T(M+1))
03460           B=X=Y=1
03470           IF X > C GOTO 3610
03480           READ :5, P
03490           IF Y > A GOTO 3610
03500           IF A(Y) = P GOTO 3560
03510           IF A(Y) < P GOTO 3540
03520           X = X + 1
03530           GOTO 3470
03540           Y = Y + 1
03550           GOTO 3490
03560           B(B) = A(Y)
03570           Y = Y + 1
03580           B = B + 1
03590           X = X + 1
03600           GOTO 3470
03610           S2(R) = T9
03620           SET :5, T9
03630           FOR X = 1 TO B-1
03640                   WRITE :5, B(X)
03650                   NEXT X
03660           T9 = LOC(5)
03670           T(M-1) = R
03680           S1(R) = B-1
03690           FOR X = M + 2 TO T
03700                   T(X-2) = T(X)
03710                   NEXT X
03720           T = T-2
03730   GOTO 3340
03740   SEARCH BACKWARD FOR "OR" OP.
03750   N = T-2
03760   IF N < 2 GOTO 4330
03770           if T(N) = 320 goto 3800
03780           if T(N) = 400 goto 4330
03790           goto 4560' Programming Error
03800           R = R + 1
03810           set :5, S2(T(N-1))
03820           A = S1(T(N-1))
03830           FOR X = 1 TO A
03840                   READ :5, A(X)
03850                   NEXT X
03860           set :5, S2(T(N+1))
03870           C = S1(T(N+1))
03880           B = X = Y = 1
03890           if X > C goto 4070
03900           read :5, P
03910           if Y > A goto 4120
03920           if A(Y) = P goto 4020
03930           if A(Y) < P goto 3980
03940           B(B) = P
03950           B = B + 1
03960           X = X + 1
03970           goto 3890
03980           B(B) = A(Y)
03990           B = B + 1
04000           Y = Y + 1
04010           goto 3910
04020           B(B) = A(Y)
04030           B = B + 1
04040           X = X + 1
04050           Y = Y + 1
04060           goto 3890
04070           for X = Y to A
04080                   B(B) = A(X)
04090                   B = B + 1
04100                   next X
04110           goto 4180
04120           B(B) = P
04130           B = B + 1
04140           for Y = X + 1 to C
04150                   read :5, B(B)
04160                   B = B + 1
04170                   next Y
04180           S2(R) = T9
04190           set :5, T9
04200           for X = 1 to B-1
04210                   write :5, B(X)
04220                   next X
04230           T9 = LOC(5)
04240           T(N-1) = R
04250           S1(R) = B - 1
04260           for X = N+2 to T
04270                   T(X-2) = T(X)
04280                   next X
04290           T = T-2
04300   N = N-2
04310   GOTO 3760
04320   wind up Boolean evaluation
04330   IF T(T-2) <> 400 GOTO 4520
04340   T(T-2) = T(T-1)
04350   T = T-2
04360   GOTO 2230
04370   wind up COMBINE evaluation
04380   IF T <> 1 GOTO 4520
04390   IF T(T) > 200 GOTO 4520
04400   S = S+1
04410   S1(S) = S1(R)
04420   S2(S) = S2(R)
04430   S$(S) = I$
04440   REM  *     PRINT & STORE FINAL SET     *
04450   PRINT USING 4460, S, S1(S), I$
04460   :              ##     ###     'EEEEE
04470   GOTO 350
04480   print "ERR8: UNRECOGNIZED CHARACTER"
04490   goto 350
04500   print "ERR12: INVALID SET NO."
04510   goto 350
04520   print "ERR9: BAD SYNTAX"
04530   goto 350
04540   print "ERR6: OPERATOR MISSPELLED"
04550   goto 350
04560   print "ERR99: PROGRAMMING ERROR"
04570   goto 350
04580   REM     * "EXPAND" SEGMENT       *
04590   IF LEFT$(I$,1) <> "#" GOTO 4820
04600   REM     * SELECT POINTER FROM EXP TABLE *
04610   LET L = LEN(I$)
04620   FOR X = 2 TO L
04630     IF MID$(I$,X,1) <> " " GOTO 4670
04640     NEXT X
04650   PRINT "ERR1: TOO MUCH SPACE"
04660   GOTO 350
04670   FOR Y = X TO L
```

```
04680      C$ = MID$(I$,Y,1)
04690     IF C$ < "0", GOTO 4770
04700     IF C$ > "9", GOTO 4770
04710     NEXT Y
04720   R = VAL (MID$(I$,X))
04730   IF R = 0 GOTO 4750
04740   IF R <= LOF(2)/5 GOTO 4790
04750   PRINT "ERR4: INVALID ENTRY"
04760   GOTO 350
04770   PRINT "ERR5: INVALID CHARACTER"
04780   GOTO 350
04790   P1 = R - 1
04800   Q9=9
04810   GOTO 4870
04820   IF T$ <> " " GOTO 4850
04830   GO SUB 6510
04840   GOTO 4870
04850   GO SUB 6510
04860   IF Q9 = 9 GOTO 4890
04870   R1 = P1-4
04880   GOTO 4900
04890   R1 = P-5
04900   IF R1>1 GOTO 4920
04910   R1 = 1
04920   PRINT
04930   PRINT " REF   DESCRIPTION   CNT   RET"
04940   PRINT " ===   ===========   ===   ==="
04950   IF R1+10 < LOF(4) GOTO 4980
04960   R2 = LOF(4)
04970   GOTO 4990
04980   R2 = R1+10
04990   SET :2, R1*5 - 4
05000   SET :4, R1
05010   FOR R = R1 TO R2
05020     READ :2, P4,C,P3,C9,P9
05030   READ :4, K$
05040   K$ = RIGHT$(K$,5) + " " + LEFT$(K$,28)
05050   IF Q9 = 0 GOTO 5080
05060   IF R = P GOTO 5120
05070   GOTO 5150
05080   IF R <> P2 GOTO 5150
05090   PRINT USING 5100, I$
05100   LLLLLLLLLLLLLLLLLLLLLLLLLLLLLL
05110     GOTO 5150
05120   PRINT USING 5130, R, K$, C, C9
05130   :#LLLLLLLLLLLLLLLLLLLLLLLLLLLLLL #
05140     GOTO 5170
05150   PRINT USING 5160, R, K$, C, C9
05160   :#LLLLLLLLLLLLLLLLLLLLLLLLLLLLLL #
05170     NEXT R
05180   GOTO 350
05190   REM *       "DISPLAY" SEGMENT       *
05200   IF LEFT$(J$,4) = "SETS", GOTO 5240
05210   PRINT "ERR17: INVALID ARGUMENT"
05220   GOTO 350
05230   REM *       PRINT DISPLAY OF SETS       *
05240   PRINT
05250   PRINT, "SET   COUNT   DESCRIPTION"
05260   PRINT, "===   =====   ==========="
05270   FOR X = 1 TO S
05280   PRINT USING 5290, X, S1(X), S$(X)
05290   :              ##     ###    'EEEEE
05300   NEXT X
05310   GOTO 350
05320   REM *       "PRINT" SEGMENT       *
05330    REM *       FORM IS:  PRINT N/M/P-Q       *
05340   L1 = LEN(J$)
05350   IF L1 < 5, GOTO 5970
05360   C$ = LEFT$(J$,1)
05370   if C$ <= "0" goto 5890
05380   if C$ > "9" goto 5890
05390   N$ = C$
05400   C$ = MID$(J$,2,1)
05410   C=3
05420   IF C$ = "/" GOTO 5490
05430   IF L1 < 6 GOTO 5970
05440   if C$ < "0" goto 5890
05450   if C$ > "9" goto 5890
05460   N$ = N$+C$
05470   IF MID$(J$,3,1) <> "/" GOTO 5910
05480   C = 4
05490   N = val(N$)
05500   if N<=0 goto 5890
05510   if N > S goto 5890
05520   M$ = MID$(J$,C,1)
05530   IF MID$(J$,C+1,1) <> "/" GOTO 5910
05540   C = C+2
05550   C$ = mid$(J$,C,1)
05560   if C$<="0" goto 5950
05570   if C$>"9" goto 5950
05580   P1$ = C$
05590   IF L1 = C GOTO 5840
05600   C = C+1
05610   C$ = mid$(J$,C,1)
05620   IF C$ = "-" GOTO 5690
05630   if C$<"0" goto 5950
05640   if C$>"9" goto 5950
05650   P1$ = P1$+C$
05660   IF L1 = C GOTO 5840
05670   C = C+1
05680   IF MID$(J$,C,1) <> "-" GOTO 5970
05690   IF L1 = C GOTO 5950
05700   C = C+1
05710   C$ = mid$(J$,C,1)
05720   if C$<="0" goto 5950
05730   if C$>"9" goto 5950
05740   P2$ = C$
05750   IF L1 = C GOTO 5810
05760   C = C+1
05770   C$ = mid$(J$,C,1)
05780   if C$<"0" goto 5950
05790   if C$>"9" goto 5950
05800   P2$ = P2$+C$
05810   P1 = val(P1$)
05820   P2 = val(P2$)
05830   goto 5860
05840   P1 = val(P1$)
05850   P2 = P1
05860   IF P1 > P2 GOTO 5950
05870   GOTO 6000
05880   REM *   ERROR MESSAGES & RETURN       *
05890   PRINT "ERR12: INVALID SET NO."
05900   GOTO 350
05910   PRINT "ERR13: NO SLASH DELIM"
05920   GOTO 350
05930   PRINT "ERR14: INVALID FORMAT NO."
05940   GOTO 350
05950   PRINT "ERR15: INVALID COUNT"
05960   GOTO 350
05970   PRINT "ERR16: INVALID FORMAT"
05980   GOTO 350
05990   REM *  POINT TO SET & VALIDATE COUNT *
06000   R1 = S2(N)
06010   R = S1(N)
06020   IF P2 > R GOTO 5950
06030   IF M$ = "1" GOTO 6090
06040   IF M$ = "2" GOTO 6180
06050   IF M$ = "3" GOTO 6180
06060   IF M$ = "9" GOTO 6180
06070   GOTO 5930
```

Program Listing 2 continued

```
06080   REM *       PRINT REC IDS ONLY      *
06090   SET :5, R1
06100   for X = 1 to P1-1
06110           read :5, Q
06120           neXt X
06130   FOR X = P1 TO P2
06140      READ :5, Q
06150   PRINT Q
06160     NEXT X
06170   GOTO 350
06180   REM *  PRINT SET'S MAIN RECORDS       *
06190     SET :5, R1
06200   for X = 1 to P1-1
06210           read :5, Q
06220           neXt X
06230   Q = P1
06240   FOR X = Q TO P2
06250     PRINT
06260   READ :5, A
06270   GO SUB 6330
06280   NEXT X
06290   IF M$ <> "9" GOTO 350
06300   WRITE #9, "@@@", "@@@"
06310   GOTO 350
06320   '
06330   REM *      FULL RECORD OUTPUT      *
06340   '
06350   IF M$ <> "9" GOTO 6380
06360   A$ = STR$(A)
06370   WRITE # 9, "ACCN = ", A$
06380   PRINT, "ACCN =";A
06390      SET :1, A
06400      READ :1, K$
06410      IF K$ = "@" GOTO 6480
06420   IF M$ <> "9" GOTO 6450
06430   WRITE #9,  K$
06440   GOTO 6470
06450   PRINT K$
06460   IF M$ = "3" GOTO 6480
06470   GOTO 6400
06480   RETURN
06490   '
06500   REM *     BINARY SEARCH SUBROUTINE      *
06510   '
06520   J1$ = LEFT$(J$,29)
06530   IF T$ = " " GOTO 6580
06540   L = LEN(J1$)
06550   IF L = 29 GOTO 6570
06560   J1$ = J1$ + SPACE$(29-L)
06570   J1$ = J1$ + T$
06580   P1 = 0
06590   P2 = LOF(4)+1
06600   IF P2-P1<2 GOTO 6700
06610   P = INT((P1+P2)/2)
06620   SET :4, P
06630   READ :4, K$
06640   IF J1$ = K$ GOTO 6720
06650   IF J1$ < K$ GOTO 6680
06660   P1 = P
06670   GOTO 6600
06680   P2 = P
06690   GOTO 6600
06700   Q9 = 0
06710   GOTO 6730
06720   Q9 = 9
06730   RETURN
06740   END
```

Exidy Sorcerer

BY CHARLES H. STROM

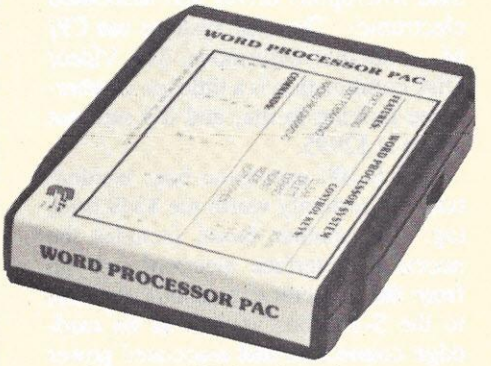
I am a chemist specializing in instrumentation and data processing. In my position at a large metropolitan university, I've had a good chance to examine the newest developments in microcomputer and microprocessor technology. I built one of the earliest Imsai 8080s and was fortunate to have the technical background necessary to complete the task — not to mention use of a state-of-the-art electronics laboratory. The early micro kits were certainly far from being Heathkit-like in their design or instructions.

As the technology developed, it became clear that any cost gains possible by building a kit were often only theoretical. Microcomputers are so complex that manufacturers, with insufficient staff, had to do a lot of "handholding." Consequently, unhappy customers often ended up with sloppily-built kits.

The Sorcerer Computer, however, is a pre-assembled, stand alone system, requiring only a video monitor and a cassette recorder to form a sophisticated microcomputer.

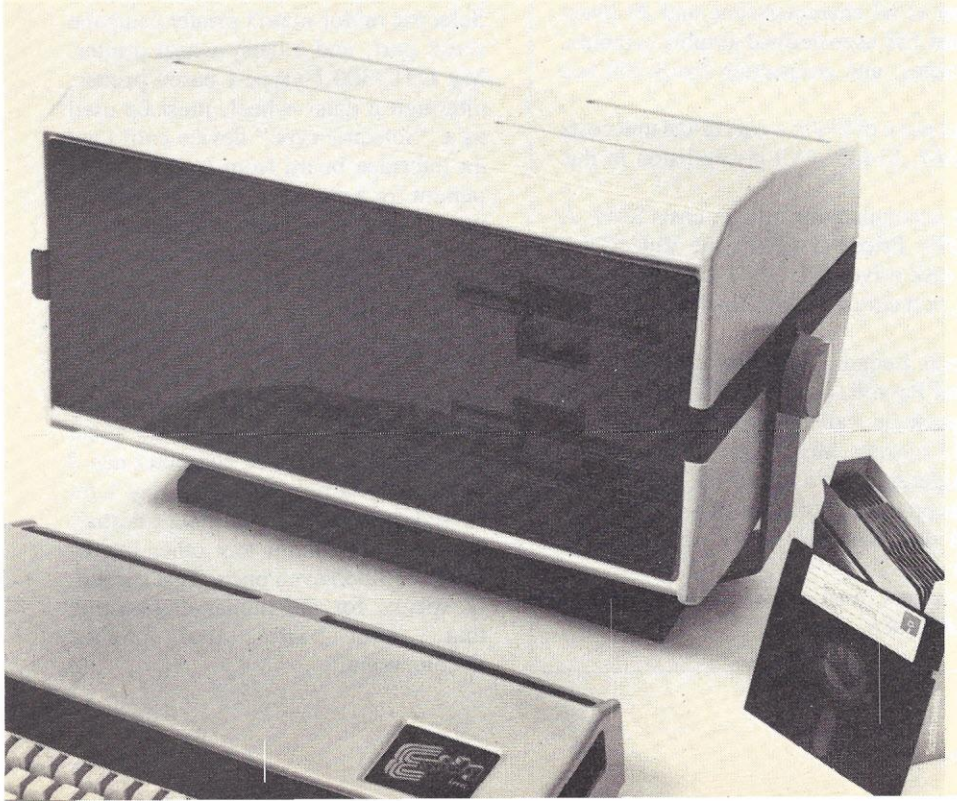
Exidy's philosophy of using plug-in ROM cartridges to hold languages as well as software packages is one of the most important reasons why I chose the Sorcerer. (Texas Instruments has also used this design with their newly introduced micro.) This technique is not only more utilitarian than having a hardwired BASIC, but it also makes software pirating a difficult proposition. Using an EPROM programmer to steal software to use in another Sorcerer is hardly worth the effort. Therefore, it makes economic sense for Exidy to develop sophisticated software packages with the assurance that the market is there. Presently, Exidy's software includes Standard BASIC (an 8K Microsoft BASIC), a Development Package and a Word Processor, each priced at $99. (See box for additional software.)

Other aspects which sold me on the Sorcerer are the ultra-reliable cassette routines at 1200 baud (as long as you have the right tape recorder — I recommend the Sony TC-62), a full upper and lower case keyboard with Pet-like graphics, a numeric pad, built- in serial and parallel ports, and easy expansion to 32K of internal RAM as well as to an S-100 bus system for reasonable cost.

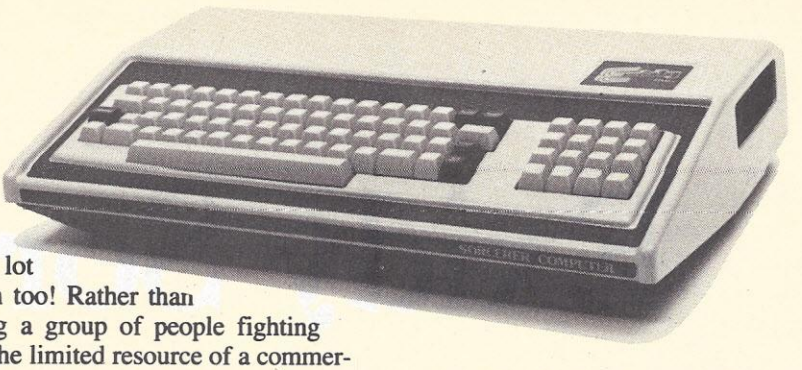


One other point which cannot be overemphasized is the people behind the product. All too often I've seen cases of great advertising with less than great hardware and even poorer technical backup. Not so at Exidy. The people are knowledgeable about their product and eager to help. I repeat: A service-oriented support staff is more important than any other single aspect in determining whether the end-user will be satisfied with the product.

If I sound too happy with the situation, don't worry; there are some problems. The Standard BASIC Rom Pac as supplied with the Sorcerer has a couple of bugs, the worst being that the routine to save arrays in BASIC doesn't work at all at 1200 baud and unreliably at 300 baud. This bug has been corrected in a new release of the Rom Pac. Another complaint is that one UART is doing a tremendous amount of work; interfacing with the serial port necessitates turning on the UART each time a character is output.



The Sorcerer's Video/Disk includes monitor, Micropolis drives and electronics, all housed in one unit.



Price for the standard computer varies with amount of internal RAM. Pre-programmed ROM Pacs contain applications programs, high-level languages and utilities.

Some recent hardware developments for the Sorcerer include disk storage and the Video/Disk. Exidy offers Micropolis drives in several configurations using their S-100 chassis or integrated into a package with a video monitor. Don't get too excited by the term Video/Disk; it's only a monitor, dual Micropolis drives and associated electronics. The disk systems use CP/M — another wise move. The Video/Disk combination is a little too cumbersome looking to me, and it's sure not cheap at $2995.

The S-100 expansion box, incidentally, is certainly worth the $349 price tag. The mother board includes the necessary interface electronics to go from the Sorcerer expansion connector to the S-100 bus as well as six card-edge connectors and associated power supply.

Newest and perhaps most exciting is the Word Processor Rom Pac. One of the primary reasons I purchased a personal computer was to do word processing. My experience at the university has shown me that word processing makes my writing more productive and is a lot of fun too! Rather than having a group of people fighting over the limited resource of a commercial word processing system, an alternative is a number of compatible inexpensive units with a limited number of printers (presently the most expensive component). Another approach is to use a distributed system; no doubt some combination will be the ultimate solution.

But let us examine the Sorcerer as an example of the former configuration. The Exidy Word Processing system has surpassed my expectations. A complete package (either cassette or disk based), it allows the usual inserts, deletes, moves, indents, tabs and so forth. The numeric pad is used as a control center. A "mode" key toggling operation shifts you between "edit" mode, where the center of the video display is always the active area (the text scrolls up and down and the cursor moves only horizontally) and the "command" mode. In the edit mode you can move the cursor, indent, tab, insert ("expand"), soft-hyphenate, delete and so forth. While in the command mode, you can do block deletions, search and replace, save or read files, format printing through a print menu, set tabs, and so on. A macro capability allows automatic execution of a string of commands.

If you're familiar with word processing, you'll see that the Sorcerer system has made few compromises as compared with expensive dedicated word processing systems. A major limitation is that the active file, held in RAM, is limited in my 32K system to about nine or ten typical single-spaced pages. You can, of course, segment a text on tape so that unlimited lengths are possible. Using a cassette storage system has made me tend to limit file size to about half the maximum allowed anyway; it's boring to wait for tape loads and saves. How easily spoiled we are — I remember that not too long ago, 1200 baud seemed fast to me!

The firmware can drive three types of printers: a Centronics-type parallel printer using the built-in parallel port, a Selectric or dot-matrix printer using the serial port, and a daisy-wheel printer. My DTC-300 Hytype-I based printer, although a daisy-wheel, must be used as a "Selectric-type" device until I get an interface board from Exidy. If I'm patient for a month or so, I'll be able to use all the nice daisy-wheel features such as boldface, super and subscripting and formfeed. Right now the printer stops so I have to do these operations manually before printing can resume.

I would not say that the system is as easy to learn as a Wang word processor, for example, but it's no great challenge for a typical computer nut. I started this article the same day I received the Rom Pac and didn't destroy any text or commit any other irrevocable boo-boo even once. That certainly speaks for the human-engineering that went into the product development. □

Systems, Peripherals and Software

Standard configuration for the Sorcerer computer includes 63-key typewriter-style keyboard, 16-key numeric pad, Z-80 processor, dual cassette I/O with remote computer control at 300 and 1200 baud data rates, RS232 serial I/O for data communications, parallel port for direct hard copy printer attachment, 4K ROM operating system, composite video of 64 characters/line and 30 lines/screen, 128 upper/lower case ASCII set and 128 user-defined graphic symbols, operation manual, cassette and video cables, and connection for S-100 bus expansion.

A Sorcerer with 8K RAM carries a retail price of $995; a 16K RAM unit costs $1145; 32K RAM, $1295; and 48K RAM, $1445. (All prices listed in this article are suggested retail prices.)

S-100 expansion unit, discussed in the accompanying article, costs $349. A 12-inch video display is available for $399. Priced at $2995, the Video/Disk unit includes 12-inch CRT, dual floppy disk drives (for 5-1/4 inch diskettes), CP/M operating system, Z-80 assembler, text editor, linking loader and Microsoft disk extended BASIC.

Applications software includes General Ledger, Accounts Payable, Accounts Receivable, Inventory Control and Payroll, priced at $99 each. All of the above programs are available in one package, called Micro Biz, for $495.

Home software includes Recipes and Calories, Measurement Conversion, Appointment Calender and Family Budgeting, each for $7.95. The Micro Home package, which includes these four programs, sells for $24.95.

In addition to extended cassette and disk BASICs, Exidy offers Fortran ($500) and Cobol ($750) for the Sorcerer.

For more information on Sorcerer products, contact Exidy Data Products Division, 390 Java Drive, Sunnyvale, CA 94086.

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CIRCLE 15

How to write for Personal Computing

You've written the programs we want to publish. You – the *Personal Computing* readers – are using your computers in businesses, homes, offices and schools. Other readers, just as software-hungry as you, are eager to try out your programs, your applications and your techniques. So why not share what you've done by submitting an article to *PC?*

It's easier than you might think. Remember: we're more interested in practical programs and useful applications than in fancy prose. And our editorial staff stands ready to help with any problems you encounter in writing your article; just give us a call at (617) 232-5470.

Here are some handy guidelines to help you get started.

First, decide what kind of article you want to write. Do you have a *business program* that will help an executive, salesman, doctor, lawyer or shopkeeper function more efficiently? Think about how businesses can benefit from microcomputers – not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost accounting are areas ripe for creative programming.

How do you use your computer for *home and personal applications* in your living room, kitchen, study or den? Again, think beyond the obvious areas of checkbook balancing and budgeting (though these areas are far from exhausted) to other applications. Hobbies, home management, household inventory, gardening and landscaping, personal income and expense analysis, personal mailing lists and word processing are just a few ideas to spark your imagination.

What *education programs* have you written for children, adults, professionals, businessmen and teachers? Computers can not only teach children basic subjects such as spelling, math, geography, economics, civics, grammar, literature and science, but can help adults review or sharpen skills in these areas as well. How else can computers function in or out of the classroom to aid learning? To help teachers and administrators?

Are you proficient in some programming technique or special computer area you could explain in a *tutorial article*? How do you save time, money, computer memory or frustration when programming or using your computer? Others can benefit from the same techniques you use.

Computer games, history, humor and *fiction* are other areas rich in article and story ideas.

Your second step is to write the text of the article. Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

Third, prepare your supporting documentation. Include at least a program listing and one or two sample runs, and add program notes to explain any special commands used or other special features of your program. Use charts, diagrams, figures and photos if they help explain your program and its use.

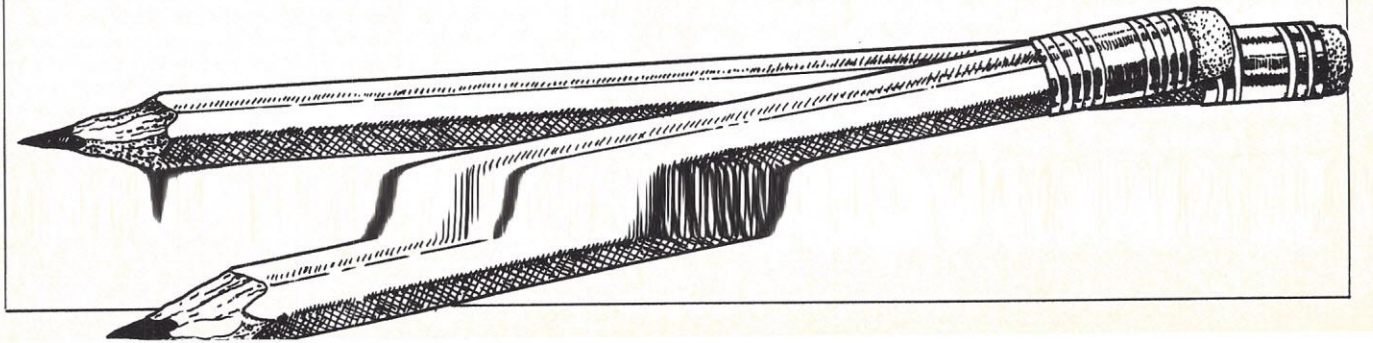
Finally, mail your manuscript. Address it to Editor, Personal Computing Magazine, 1050 Commonwealth Ave., Boston, MA 02215.

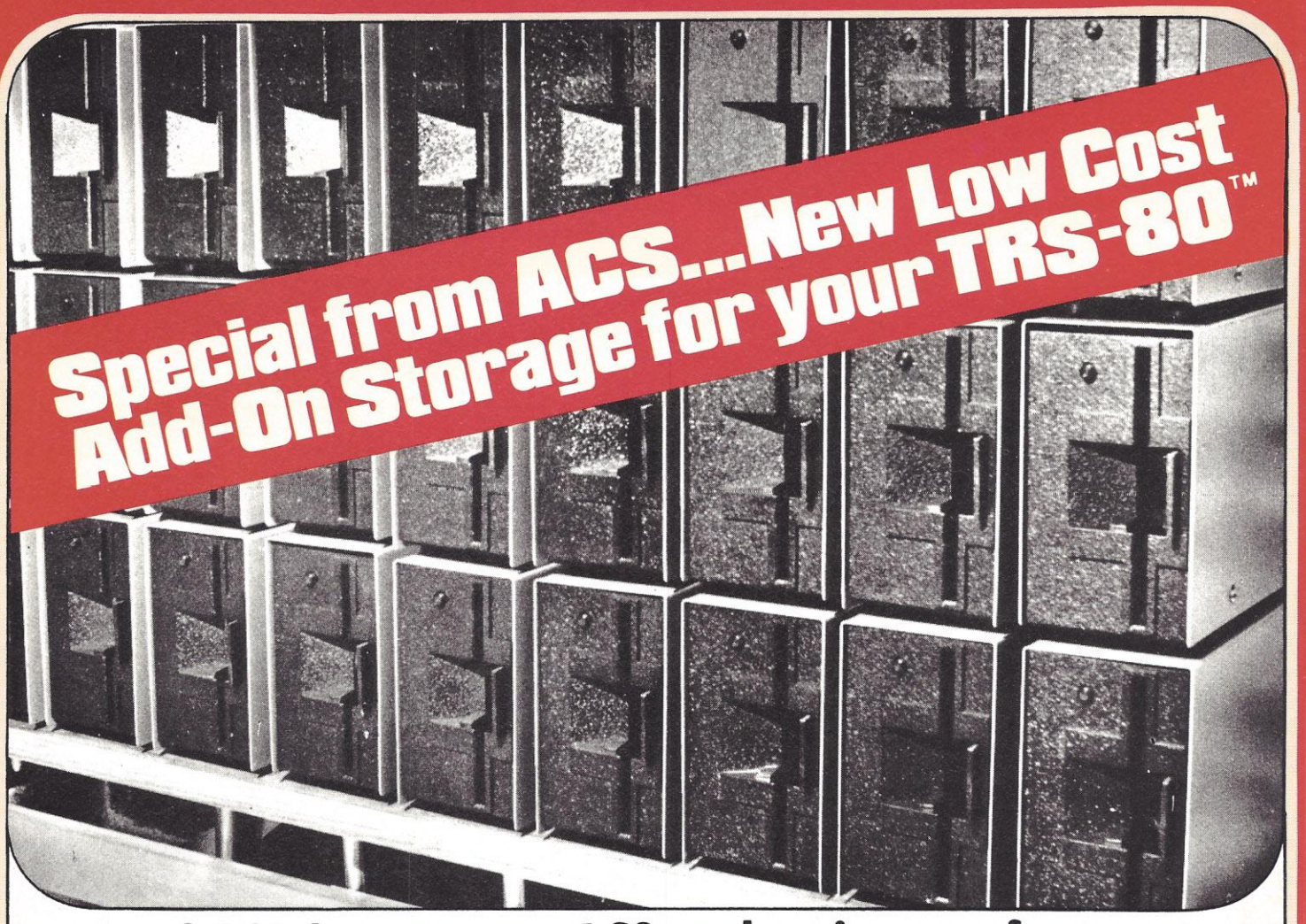
A few suggestions: All submissions should be original, typed (*not* all CAPS), double-spaced and neat. Please include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material.

Since we photograph program listings and sample runs exactly as you send them to us for publication in the magazine, please be sure you use a fresh ribbon for computer printouts. If you don't have a printer, you can type your listings single spaced; but again, be sure you use a new ribbon. (If your program relies heavily on graphics, you can photograph sample runs from your CRT. But take care to avoid distortion due to the curve of the screen.)

Feel free to call us if you have any questions or want to discuss specific ideas. We can give you feedback and suggest appropriate slants and approaches.

We're always looking for fresh, original ideas. While these guidelines will help you in preparing material for *Personal Computing*, don't assume we don't want your idea just because it's not mentioned here. Let us and our readers know what *you're* doing with your computer.





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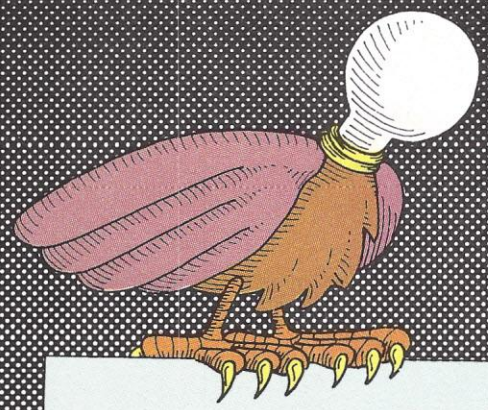


Alien Names Made Easy

BY DONALD W. FAIRHURST

Many excellent science fiction writers, however inventive their plots may be, seem to lack the ability to invent extra-terrestrial names which are neither too Earthlike nor so utterly alien as to be unpronounceable and unreadable.

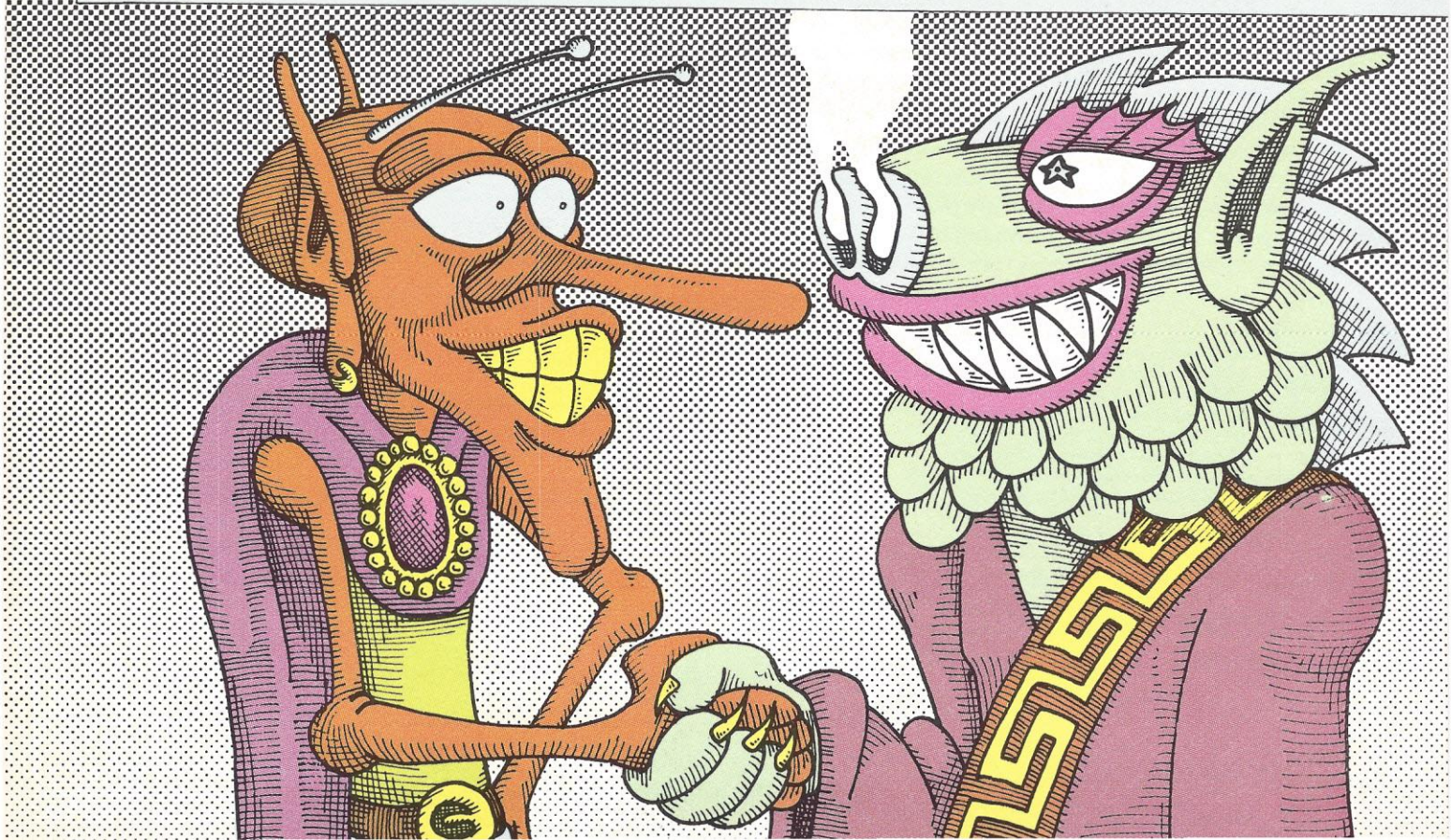
Some authors use names from various mythologies, but these may give readers who recognize them problems because they do not fit the personalities of the new characters. Other authors produce strings of consonants, usually with a few apostrophes thrown in, on the grounds that even humanoid aliens would (or at least might) have a vocal apparatus quite unlike that of Earthlings. While this may turn out to be true if we ever meet any aliens, such weird names in stories are hard for readers to understand and remember. If a story contains two or more aliens with names like T'klxctsz and Rg'lklz, the poor reader may not be able to remember from one chapter to the next which alien is the drug pusher and which is the Venusian Police Commissioner.

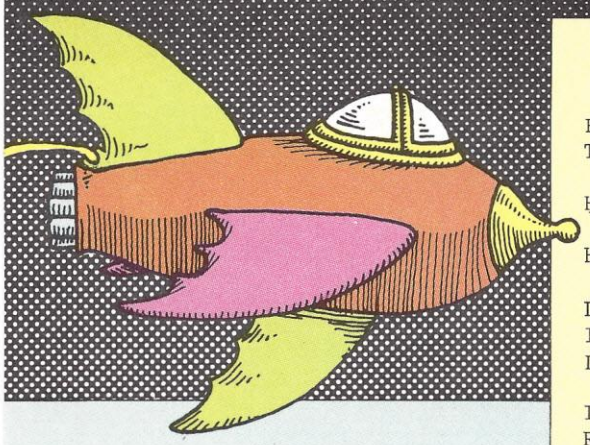
In her award-winning novel *The Dispossessed,* Ursula K. LeGuin postulated a society in which all people were equal. Children were named not by traditional methods which follow class or sex distinctions, but by computer. (Mrs. LeGuin, by the way, knows enough linguistics to invent alien yet reasonable names. She and L. Sprague DeCamp are two honorable exceptions to my complaint above.)

As a professional linguist and language teacher who is also both a computer hobbyist and a long-time science fiction fan, I would like to offer a simple solution to the problem in the form of a short program. This program will invent as many alien names as you want, with all the names following a pronounceable consonant-vowel pattern. Written in Radio Shack Level II BASIC, the program occupies less than 1K of memory.

I omitted a few consonants (J, Q, W, Y) from the string array because I felt they would tend to make the names too unpronounceable for an English-speaking reader. On the other hand, I included three consonant sounds written with digraphs (CH, SH, TH).

All names produced by this program follow the CVCCVC consonant-vowel pattern found in many languages, but other patterns can be set up very easily. Radio Shack Level II makes it very simple to edit a resident program. By changing the A$/B$ pattern (A$ for vowels, B$ for consonants), you can obtain any desired arrangement. You might try CVCVC or CVCVCV, for





example, since both of those patterns produce easily pronounceable names.

Another linguistically feasible possibility is to have a long, or double, consonant in the names. This pattern will occur occasionally at random in the program as written, but can be done consistently by deleting lines 160 to 170 and changing line 140 to

140 PRINT B$(B);B$(B);

This change gives names like Kollun, Dassif and Meggor. I suggest dropping CH, SH and TH from the B$ array to make the names look more "normal". Reduce the B$ random number in line 1000 accordingly.

While this program won't cure writer's block, it might serve as a stimulus. And we Earthlings can even use it to give nicknames to our friends, or names to our pets! □

Sample Run

```
RUN
THIS PROGRAM INVENTS ALIEN NAMES

HOW MANY NAMES DO YOU WANT? 15

HERE ARE YOUR 15 ALIEN NAMES:

LOPNAZ SHIRBUL FIFFIG NETHTAR KOLKOM GATLECH RINBOP
ID DOTHBER MEFFAD LACXIN SISHNUK LILTIC PIZLUG CAXP
DUFPU

IF THESE WILL NOT DO, TYPE 'RUN' FOR ANOTHER SET
READY>_
```

Program Listing

```
1 REM ALIEN NAMES PROGRAM BY DONALD FAIRHURST
2 REM RADIO SHACK LEVEL II BASIC
10 DIM A$(5),B$(19):RANDOM
20 A$(1)="A":A$(2)="E":A$(3)="I":A$(4)="O":A$(5)="U"
30 B$(1)="B":B$(2)="C":B$(3)="D":B$(4)="F":B$(5)="G":
   B$(6)="K"
40 B$(7)="L":B$(8)="M":B$(9)="N":B$(10)="P":
   B$(11)="R":B$(12)="S"
50 B$(13)="T":B$(14)="V":B$(15)="X":B$(16)="Z":
   B$(17)="CH":
55 B$(18)="SH":B$(19)="TH"
60 PRINT "THIS PROGRAM INVENTS ALIEN NAMES":PRINT
70 INPUT "HOW MANY NAMES DO YOU WANT";C
75 PRINT:PRINT "HERE ARE YOUR";C;"ALIEN NAMES:":PRINT
80 FOR I=1 TO C
90 GOSUB 1000
100 PRINT B$(B);
110 GOSUB 1000
120 PRINT A$(A);
130 GOSUB 1000
140 PRINT B$(B);
150 GOSUB 1000
160 PRINT B$(B);
170 GOSUB 1000
180 PRINT A$(A);
190 GOSUB 1000
200 PRINT B$(B);" ";
210 NEXT I
220 PRINT:PRINT "IF THESE WILL NOT DO, TYPE 'RUN' FOR
    ANOTHER SET"
230 END
1000 A=RND(5):B=RND(19) :RETURN
```

Illustration by Josh Randall

Part 1

Holiday Buyer's Guide

BY DON WOOD

A nip in the air tells you the holiday season is just around the corner. Now's the time to start thinking about gifts for your computerist friends, family and even yourself.

This two-part article will take a look at some of the products now on the market. This month we'll look at software, and next month at systems, peripherals, boards and other items. You'll find still more products in our What's Coming Up department — both this month and in past issues. And see this month's Computer Chess department for a selection of chess-related gift ideas.

Computerists have an insatiable appetite for programs. Without software, a computer just sits there, blinking its cursor. And programs make excellent gifts — cassette tapes and floppy disks are relatively inexpensive, small, compact and easily mailed. And cassettes will nestle neatly among the walnuts, oranges and candy canes in a Christmas stocking. (But please don't try to fold a floppy disk to make it fit in a stocking; your friend would much prefer it in unmangled condition!)

If you're buying by mail, be sure you get your orders in early to avoid the holiday mail rush and to insure you receive your merchandise in time. Also, exercise caution in dealing with mail-order firms. Outright frauds are rare, but legitimate companies sometimes face legitimate difficulties in delivering products. And, unless you do some checking first, you may find the product delivered does not live up to your expectations. Be sure you know what you're buying and the basis on which you can return it for a full refund. You want to buy a source of pleasure and enjoyment — not a source of ulcers and coronaries.

When buying software for a friend or family member, make sure the program will run on their system. A Pet program won't work on an Apple; and a TRS-80 tape is useless to a Sorcerer owner. A floppy disk won't work on a cassette-based system (unless you buy a floppy disk drive to go with it); and a 32K program is just too big for a 16K machine. If a program requires a printer, check that your friend has one.

Computer Games

One axiom in the personal computing field is that computerists love to play games. The tradition dates back to the very earliest days. The scientists and engineers who first developed computers in the 1940s used their primitive machines for game playing during off-duty hours. So let's take a look at some games you can buy.

Backgammon and Labyrinth are two Pet games from Minnesota Micro Systems. Backgammon ($19.95) is an aggressive and fast program, the company said, playing by standard tournament rules, including doubling. Labyrinth ($12.95) is a graphic adventure game featuring a medieval castle with various floors and varying levels of complexity. Swords, daggers, keys, magic rings and cloaks will assist you in your search for gold while you fight off dragons, goblins, ogres, trolls and giant spiders.

Bike, a Pet simulation game from Softside Software, puts you in charge of a bicycle manufacturing empire. You must juggle inflation, breakdowns, seasonal sales variations, inventory, workers, prices, machines and ad campaigns to keep your enterprise in the black. The company's Driving Ace tape features two arcade-type racing games. One simulates an endless road with twists and turns; the other simulates a crowded Grand Prix race track. Pinball is a Pet graphics game featuring bumpers, chutes, flippers, free balls, gates and a jackpot. Price for each of these Pet games is $9.95 on cassette.

Science fiction fans will like Automated Simulations' line of computer games. Starfleet Orion, a two-player adult strategy game for Apple II, features sound and high-resolution color graphics. The computer keeps track of the rules, prompts the players for their orders and resolves combat. An introductory scenario allows play to begin rapidly, but the other eleven scenarios vary widely in complexity and length. You can also concoct new scenarios using either the suggestions and ship types given or your own ideas of hyperspatial superdreadnought. The cassette includes two programs, one for battles and one for scenario building. The Apple game includes both a basic 16K version and a 32K battle program. Applesoft is not required. Starfleet Orion is also available for 8K Pet and 16K TRS-80 Level II. Price is $19.95.

Invasion Orion, a solitaire science fiction strategy game, includes ten

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CIRCLE 10

scenarios. The player controls from one to nine ships against a comparable enemy force, but for further variety he can play the robotic Klaatu while the computer takes the human side. The computer's skill level can be adjusted to provide a challenge for players of widely varying experience and ability. The program is available for 16K Pet and TRS-80 (Level II, 16K RAM) on cassette. Either version costs $19.95 from Automated Simulations.

The Temple of Apshai, available for TRS-80 and Pet, is a solo fantasy adventure game featuring ancient legends, fearsome monsters and spectacular treasures. You can take the part of one of more than fifteen million characters the computer can generate. Or, the same character can return to the dungeon again and again — as long as he continues to survive. In addition to selling you the necesary imaginary equipment (swords, armor and the like) and then keeping track of it, the computer draws a map of the appropriate sections of the dungeon, handles the rules and allows you eighteen options in the course of an adventure. These options range from fighting or running to eavesdropping or searching for traps. The program is written in BASIC for the TRS-80 (Level II, 16K RAM) for either cassette or disk and for the PET with 32K RAM and cassette drive. Each version costs $24.95 from Automated Simulation.

An extensive line of TRS-80 Level II programs is available from Cybermate. NLOS/1 (16K) builds conversational data bases so your computer can read and understand English. Maze/1, a 4K program, generates mazes of varying complexity. Constellation (16K) produces a graphics display of the night sky — either as seen from Earth or as seen from a planet around another star. Cartoon lets you create and run animated pictures (4K). Other programs let you challenge your computer to a game of Monopoly or checkers (each 16K), or Scrabble, tic-tac-toe or poker (4K each). War, space war and arcade games are also available. Each Level II program costs $4.95 on cassette or $1.95 in source listing form. You get a 10% discount with an order of two or more programs; and you can buy all 41 of the company's source programs for $19.95. Cybermate plans to offer programs on diskette for $6.95.

Muse offers a wide selection of cassette and disk games for Apple computers. Uncle Sam's Jigsaw, an educational game for children, helps teach geography. The $12.95 cassette requires Applesoft board and 32K. In Global War, an adult strategy game, two to nine players vie for control of the world. The $17.95 price includes cassette, instruction manual and rule book. The program requires 32K and Applesoft board.

Three Mile Island, another Muse game, simulates a pressurized nuclear reactor. You must supply power to your customers at a profitable rate, or lose your license to operate. Four graphic displays monitor the containment building; the turbines, filters and condenser; the reactor core; and the pump house. You must juggle valves, pumps, turbines, filters and control rods, as well as maintain and repair equipment, to keep your nuclear reactor running safely and profitably. The $39.95 disk requires a 48K Apple. Other Apple games from Muse include Escape, Tank War, Maze Game and Side Shows.

Soft-One's Apple II Software Library is an easy way to expand your program library inexpensively. Each of the two volumes contains a number of games, teaching programs and utilities. Volume I has Starwars, Pong With Bricks, Mathtest, Story Teller, Saucer War, Tic-Tac-Toe, Stock Market (a one-player simulation) and Craps, plus other demos and utilities. Volume II contains Pong/Handball, Poet (computer generates verse), Chase (an action game), Game of Life, Air/Sea War, Long Divide (practice long division), Battleship, Bach Music, Startrek plus others. Each is supplied on cassette for $14.95.

Hayden Book Company offers a constantly expanding line of program tapes for Pet, TRS-80, Kim, Apple and Exidy Sorcerer machines. Sargon, the championship chess program, is available for TRS-80 Level II and 24K Apple II for $19.95. The First Book of Kim (Tapes 1 and 2, $9.95 each) features games and programs for the Kim. Game Playing with BASIC (Tapes 1, 2 and 3, $9.95 each) includes games for Pet, TRS-80 Level I or II and Apple II. (Tape 3 is not available for TRS-80 Level I.) For the Pet, the company offers Crossbow, a target game, and Mayday, an airplane flight simulation, for $9.95 each. Backgammon lets you play against the computer, and the baseball game Batter Up features three levels of display; both are available for Pet and TRS-80 Level II for $10.95 each. Gridiron is a $12.95 football game for TRS-80 Level II.

Home Programs

In addition to game playing, personal computerists like to find practical applications for their micros. Here are a few programs useful around the house.

Personal Accounting System for North Star requires 24K and one disk drive. The system, which uses mnemonic account numbers, consists of six programs to do editing of data, posting, balance sheet, check and credit card reconciliation, and journals by month or account. The $35 disk from Surf Computer Services comes with instructions and sample data.

Magazine Data Base System from Surf Computer Services can be modified for other applications as well. You can add, delete, change, dump or search by magazine, subject, or subject within magazine. The program comes complete with data files containing over 1000 computer magazine articles and documentation about data base concepts as well as the program. Written in BASIC for North Star systems, the $35 program requires 32K of memory.

Air Conditioner Selection Program lets you determine what capacity air conditioner you need in BTU/hour. The program takes into account heat gain through windows, walls, ceiling, floor, electrical equipment and number of people in room, and heat loss through doors and arches. In addition, the program applies a correction factor based on geographic location within the U.S. Price for the North Star BASIC program (which requires 32K memory) is $40 for HSC Computer Services.

Solar energy designers and astronomy buffs may like Sungraph, a program to calculate and graph the position of sun. The sun's local elevation and azimuth can be calculated at any location on earth. Options include graphs of elevation vs. time of day,

azimuth vs. time of day, maximum elevation vs. date, and elevation at a specified azimuth vs. date. A save option allows a graph to be stored on cassette. Written in TRS-80 Level II BASIC, the program requires 13K bytes of storage and is available on cassette for $49 or diskette for $75 from Solartek.

Applications for Software Exchange's TRS-80 Telephone Dialer include use as an aid for the handicapped and for babysitters. The program lets your computer operate a dial or push-button phone. You can call 20 telephone numbers using a single-letter code — for example, push "F" to call the fire department or "P" for the police. Priced at $7.95, the cassette tape includes instructions for building a simple interface from about $4 worth of Radio Shack parts. Specify Level I or Level II.

TRS-80 owners should definitely take a look at the offerings from The Bottom Shelf. This company offers a continually expanding line of programs and accessories for Radio Shack's computer. Library 100 is a set of over 100 programs — business, education, graphics, home use and games; price is $49.95. Business Mail System, for dual disk and printer, can handle up to 150,000 names ($125). Checkbook II, a cassette and disk based personal finance program, costs $18.50. System Doctor, a computer diagnostic program, sells for $28.50. Exerciser, an aid in establishing a physical fitness regimen, costs $12.50. Many other programs are available. A copy of their catalog, called Systems Extensions, costs $3.

General Mathematics-1 and Engineering Mathematics-1 contain programs of interest to math, science or engineering students — or professionals in these fields. Both tapes are available from Hayden Book Company for TRS-80 Level II and Apple II for $14.95 each. The General Mathematics tape contains 15 programs including Log to Any Base, Rectangular Polar Coordinates, Permutations, Vector Cross-Products, Max/Min Locator, Dimension Scaler, Circle Finder, Nth Root of a Number and Distributed Random Numbers. The Engineering Mathematics tape offers 8 programs including Solving Simultaneous Equations, Evalution of a Polynomial, Quadratic Equations and Derivation of a Function.

You can write your own computer-assisted instruction programs using text, graphics and sound with Appilot from Muse. Appilot is an Apple II version of the dialog-oriented CAI language Pilot. Enhancements include color graphics commands, a musical mini-language and disk commands for lesson segmentation that give an effective lesson size up to 100K. Written in assembly language, Appilot links to Apple's Integer BASIC, allowing use of Integer BASIC commands within Appilot lessons. The system includes program editor, program interpreter and on-line help lessons to assist users in program development. The $49.95 disk comes with a detailed user's guide.

Book Inventory, a program by Holliday Software, files and maintains an inventory of books on a disk. The program can also be used for other types of data bases. Written in CBASIC-2, it requires the CP/M operating system, 36K of contiguous RAM, at least one floppy disk drive and a terminal/keyboard.

Special features simplify operator interaction and make the program easy to use. For example, an English language selection menu is presented when an operator response is required. Just type in the desired command to use any of the functions.

Options allow operation with different hardware configurations. A Demo flag allows changing the codes output to the hardware for clearing the screen, homing the cursor and printer form feed. A Debug flag causes a message to be printed each time the files are accessed.

Documention includes a user manual which describes available functions, file organization and database structure. The software, distributed on an 8" diskette in CP/M format, includes run time modules and sample data base. CBASIC-2 is not included. Suggested price is $19.95.

Programming Aids

Few people own a computer for very long before they're eager to try out their machines — and their own skills — by writing programs. This selection of programming aids is designed to help you in creating your own software.

The BASIC Programmer's Toolkit, a collection of machine language firmware aids for the Pet, comes in the form of additional ROM storage, avoiding the need to load tapes or give up valuable RAM storage.

When you type Auto, the Pet starts prompting you with evenly spaced numbers. You can Delete a specified range of lines easily. Find will list only selected lines which contain some set of characters you specify. Thus, with one command, you can find all references to the variable "W9", for example. When you get an error message from BASIC, type Help and the system will automatically list the line that BASIC quit on and highlight in reverse video the erroneous portion. You can also Trace a program or single Step it. Renumber will do just that; Append merges two programs; and Dump displays the names and values of variables in an executing BASIC program. The Toolkit retails for $50 (for new 16/32K Pets) and $80 (for old 8K Pets) from Nestar Systems.

Softside Software offers a line of Pet computer programs. Their Graphics Pac 2 BASIC subroutine quadruples your Pet's graphic resolution, letting you directly control 4000 points on the screen. Useful for graphing, plotting and games, the program operates in two modes: four quadrant graphing with (0,0) in the center of the screen, and standard graphing with (0,0) in the upper left hand corner. Documentation shows you how to merge this routine with your own programs without retyping. Price is $9.95 on cassette. Super Doodle turns your Pet screen into a sketch pad. You can move the cursor in eight directions, leaving a trail of any of the 256 Pet characters. Features include an erase key that automatically remembers the last five characters typed, a return-to-center key, and clear control. This cassette costs $9.95. Assembler 2001 is Softside's 6502 assembler for the Pet. Price is $15.95 (cassette).

Racet Computes markets a number of programming aids for the TRS-80. One impressive package, called Infinite BASIC, adds over 70 commands to TRS-80 BASIC. You get matrix functions, including read, inverse, transpose, identity and simultaneous equations; add, subtract or multiply scalars, vectors or multidimensioned

arrays; dynamically reshape, expand, delete arrays; change arrays in mid-program; copy array elements, set arrays to scalar, zero arrays, move arrays; tape array read and write including string arrays. In addition, you get string functions including left and right justify, truncate, rotate, text justification, string centering; deletion or insertion of substrings, pack strings, convert to upper or lower case; translate characters, reverse strings, verify function, test number of occurences; masked string searches for simple or array variables; encrypt or decrypt strings; and others. Infinite Business, an add-on package for Infinite BASIC, adds functions to assist in writing business programs. Infinite BASIC costs $49.95; Infinite Business is $29.95.

A disk-based Apple Data-Graph Program permits Apple to graph data in hi-res graphics. You can instantly dimension x and y axes, enter up to 40 pieces of data per curve and plot up to 3 curves on the same graph. The data, entered from the keyboard, may be saved off-line, with axis information, for instant replotting. The program requires 32K of memory, and costs $20 postpaid from Connecticut Information Systems.

Futureworld's x,y Genesis is a set of Applesoft II BASIC subroutines that help place points, lines, shapes and labelled x and y axes on the high resolution graphics screen. This aid allows a programmer to think in terms of a finished screen rather than the techniques for plotting such a screen. In addition, the system creates high resolution shape tables. The company supplies a shape table which includes all the keyboard characters plus some special symbols, as well as demonstration programs. x,y Genesis runs on a 32K Apple II with Applesoft II firmware card and disk drive. Price is $74.95.

Dann McCreary's Apple-80, an 8080 simulator and debug package for the Apple II 6502-based computer, lets any 16K or larger Apple run programs written for the 8080. Also, the package can be used as a design aid for developing original 8080 software. The complete package includes an Apple-80 manual, an 8080 demo program and a reference card. Price is $20 plus $1.50 shipping and handling; California residents must add 6% sales tax. A Kim-1 version is also available.

If you're running Micropolis BASIC on a Micropolis Mod II Disk System, you'll find Computer Services' Machine Language Sort Utility a useful addition to your software library. This utility quickly sorts arrays of strings in memory into ascending alphabetical order. Strings may be up to 250 characters long, and the number of items is limited only by your memory size. When ordering, specify the memory size of your computer and the version of Micropolis BASIC you use. Price is $59.50 plus $2 shipping. California residents add 6% sales tax; overseas, add $5.

For Fortran programmers, the String Bit should prove a valuable aid. This library of relocatable routines lets you add simple yet sophisticated string handling features to your Fortran programs. More than two dozen routines give you capabilities to find, pack, fill, move, separate, concatenate and compare character strings. You can count the occurence of one string in another as well as insert, replace, delete and reverse characters and substrings within other strings. Many other functions are also supported. The software is distributed on a 5-inch or 8-inch soft sectored, CP/M-compatible disk for $45 from Key Bits, Inc.

Business Software

While many business packages are priced out of range of the family holiday budget, this is the time of year to review your past year's business and see if your computer can help you make more profits in 1980.

Mail-V is a mailing list system for TRS-80 DOS, 32K. This $59 package from Micro Architect features easy editing and a report writer to allow you to specify label formats on-line. Selection criteria, field calculations and multiple-sort keys are supported. Fields include Zip code extensions and a remark field. Any fields can be sorted. The system comes on diskette with documentation; a CP/M version is scheduled.

Calc, another TRS-80 small business program from Micro Architect, aids in depositing checks across several bank accounts. The program lets you select the bank account and enters all the checks to generate a total for deposit. After all accounts are entered, the system displays the grand total. A check balance program is also included. Price is $20; Level II and 16K are required.

A stock market quotation system called Tickertec runs on the North Star Horizon computer or an 8080/Z-80 system with a North Star disk drive; a low-end version is available for the Radio Shack TRS-80.

Users submit a special application to the New York or American Stock Exchange for a non-delayed low speed ticker line to their home or office. The software constantly reads the ticker data, interprets the information and provides the following basic services in all of its systems:

- Maintains lists of ticker symbols for securities which the user wishes to monitor.
- Displays last sale price and total volume traded for each monitored security.
- Alarms the trader if a stock trades outside of a user determined trading limit.
- Displays a history of the last 10 prices and volumes traded for each security.
- Displays the moving tickertape.
- Reports on market volume and indices each half hour.

Top-of-the-line systems can include a number of special options.

Tickertec-TRS will monitor 48, 96 or 150 securities. Other Tickertec systems maintain a minimum of 150 ticker symbols. Software prices begin at $1000. Complete systems, which include all required hardware and software, are also available from Intersystems Software.

Occupational Computing Company offers a number of accounting and management programs for TRS-80 with 32K RAM, two disk drives and printer. Their Accounts Receivable, Billing and Inventory Control package for finished goods costs $1495. Accounts Payable and Payroll programs cost $350 each. Other software includes Client Accounting ($1495), Securities Graphics ($495), Medical Billing ($1495), Radiologist-Aide ($1995), Trucking-Aide ($1995) and Construction-Aide ($1995).

Diskette-based TRS-80 business programs and subroutines are available

from Johnson Associates Software. Their Indexed Sequential Access Method system (ISAM) is a series of subroutines you can use in your own programs to store or retrieve data by a "key field" within the record. Utility programs let you create a new data file or reorganize an old one. You can have up to 22 fields of any length per record, up to a total of 252 characters per record. You can add, update or delete records at any time, and retrieve records randomly by key or in key sequence. The ISAM package costs $50.

Johnson Associates' Transaction Data Entry system gives you subroutines to handle business application keyboard data entry on your TRS-80. The routines display a data entry form on the screen and provide a blinking cursor to guide operator keyboard entry. The system provides automatic field length checking and alerts the operator if excessive characters are keyed. A stand-alone utility lets you prepare and store on diskette the various data entry screens your application requires. The system, on diskette, costs $20.

Information Retrieval System is a program to maintain a disk file of user-supplied information (titles), source (reference pointer), and attributes (subject matter). Up to 36 attributes are allowed for any specific data base, and any single entry can have 1 to 36 attributes. You can search the data base by attribute, as well as add new entries and update old entries. Output can be directed to the screen, printer or to another disk file. This TRS-80 program costs $20 on diskette from Johnson Associates Software.

Both financial professionals and casual investors will find programs of interest in H & E Computronics' Stock Market Pac. This collection of programs aids in evaluating, selecting and managing investment portfolios. Programs in the package include Earnings per Share Estimation, Compound Interest, Annuities, Uneven Cash Flows, Stock Valuation, Option Valuation, Option Writing, Warrant Valuation, Bond Valuation, Stock Indicators, Portfolio Selection, Capital Accumulation Planning and Days Between Dates. The $49.95 package requires a 16K cassette or 32K disk TRS-80 system; specify disk or cassette when ordering.

Dr. Memory, a disk-based word processor from Muse, lets your Apple computer print out lower case letters without additional hardware (except an upper/lower case printer, of course). The program prints lower case unless you use control characters to specify upper case. You can control left and right margins, inter-line spacing, end-of-page eject, automatic paragraphing, right margin justification and paragraph indentation. In addition, you can insert, delete, change, find, merge and block move text. The block move feature lets you move blocks of text within a single text file or from one disk text file to another. The assembly language program occupies less than 4K and can be operated at normal typing speeds, the company said. Price is $49.95.

Your Apple computer can be used as an automated advertising machine to promote any product at indoor locations such as stores, hotels and trade shows with three advertising programs from Connecticut Information Systems. The Scrolling Wonder allows four brief flashing slogans to pop up randomly from the bottom of the screen. Giant Letters flashes brilliantly-colored, full-screen sized letters on the screen consecutively until a message is spelled out. A running summary of the message is presented in standard Apple characters beneath the giant letters, to help viewers keep track of the letter sequence. Hi-Res Alphanumeric Message allows four lines of crisp characters, 28/line, each character 1/8 screen height, to be "puffed" on at comfortable reading speed to form a message. When four lines are filled, a page dissolve occurs and another page can be filled. Capacity is three pages; the message can be made to linger or repeat. All three programs are available for $30 prepaid on disk (32K).

Muse's Micro Information System for the Apple handles all types of data bases — accounts payable/receivable, inventories, appointment calendars, personal finance and checking accounts, cost estimating, real estate listings, sales solicitations, selective mailings, manpower accounting, dietary information, phone directories and others. You can selectively retrieve information; for example, you could access a dealer list alphabetically by name or in order of ascending outstandings. Or you could quickly locate employees earning more than $20,000 with a simple command. You can total and average numeric data and count selected records. In addition, you can use variable record weighting to provide composite analyses such as inventory valuation and construction costs. The program requires 32K (48K recommended) for use with the Applesoft board; or 48K for disk Applesoft. Price for the disk is $99.95.

Business people using Ohio Scientific Challenger II and III floppy disk systems should take a look at the BPS product line. BPSort, an assembly language sort/merge utility, handles up to five keys specified for ascending or descending, alpha or numeric ordering. The $99 program requires a 32K, OS-65 (U) level system. BPSort is included in The BPS, an interactive information management system. The BPS features menu selection and full screen formats to define and store information. Data records are displayed and altered quickly using formatted screens. The package, which requires OS-65 (U), costs $500.

Payroll, another OS-65 (U) program from BPS, computes weekly, bi-weekly, semi-monthly or monthly payroll for an individual or an entire staff. The program handles piecework, contract, hourly or salaried personnel. Federal, state and local tax tables, included in the program, can be altered to conform to new laws and differing tax jurisdictions. Payroll requires the BPS and costs $250.

Super-Sort Mail-List and Lookup System from HSC Computer Services runs on any computer with CP/M and CBASIC. The system features nine fields: Attention Of, Company Name, Street Address, Room Number, City, State, Zip Code, Area Code and Telephone Number, and Selection Category Code. The Zip Code handles up to 10 characters, so you can use foreign postal codes as well (and you'll be ready when the U.S. Post Office goes to longer Zip codes). You can sort any of these fields for mailings or reports. The system requires two disk drives, 48K memory, a terminal and a printer. It is available on North Star mini-floppy diskette or on 8-inch diskette.

Price is $125. A CBASIC-2 version costs $150. The company expects to have an enhanced version available by Christmas. The new, $200 system will let you store a form letter in file; the system will then print out the letter, plugging in names and addresses.

Pricelist, also from HSC Computer Services, lets your sales personnel quickly look up costs and selling prices of items in your store. The system holds about 1000 records per diskette. Written in North Star BASIC, the $40 program requires 32K memory.

Cash Disbursements, written in North Star BASIC, allows storage of date, check number and amount. You can instantly recall data stored for any month plus perform a number of other functions. The program requires 40K memory. Price is $60 from HSC Computer Services.

Maryelln, a text editor/word processing system for the North Star disk, contains features of the North Star BASIC editor, string handling features of large computer editors, and word processing capability. There are 33 commands, including Auto, Delete, Renumber, Scratch, Load, Save, Null, Edit, List, NSave, Append and Quit, similar to those commands in North Star BASIC. String handling commands allow you to find and change characters or phrases, or move and copy entire lines of text. Word processing commands include Insert, Title, Line, Space, Unit, Page, Justify, Tabset, Repeat and Print. Line fill, right justification, centering of titles, page numbering, titles, and forms control are done under the Print command. Maryelln, written in 8080 assembler language, costs $44 from Surf Computer Services. □

Buyer's Guide Vendors

Automated Simulations
P.O. Box 4232
Mountain View, CA 94040

The Bottom Shelf
P.O. Box 49104
Atlanta, GA 30359
(404) 939-6031

BPS
322 West 57th St.
New York, NY 10019
(212) 765-0815

Computer Services
P.O. Box 81243
San Diego, CA 92138
(714) 438-9137

Connecticut Information Systems Co.
218 Huntington Road
Bridgeport, CT 06608
(203) 579-0472

Cybermate
R.D. #3 - Box 192A
Nazareth, PA 18064

Dann McCreary
Box 16435 - T
San Diego, CA 92116

Futureworld
2514 University Drive
Durham, NC 27707
(919) 489-7486

H & E Computronics, Inc.
Box 149
New City, NY 10956

Hayden Book Company, Inc.
50 Essex St.
Rochelle Park, NJ 07662
(201) 843-0550

Holliday Software
4807 Arlene St.
San Diego, CA 92117

HSC Computer Services, Ltd.
P.O. Box 43
Brooklyn, NY 11236
(212) 780-0022

Intersystems Software, Inc.
42 Manors Dr.
Jericho, NY 11753
(201) 871-4085
(516) 433-8118

Johnson Associates Software
P.O. Box 352
Palo Cedro, CA 96073

Key Bits, Inc.
P.O. Box 592293
Miami, FL 33159

Minnesota Micro Systems
514 Cedar Avenue
Minneapolis, MN 55454
(612) 338-5604

Micro Architect
96 Dothan St.
Arlington, MA 02174

Muse Software
7112 Darlington Dr.
Baltimore, MD 21234
(301) 661-8531

Nestar Systems Inc.
430 Sherman Avenue
Palo Alto, CA 94306
(415) 327-0125

Occupational Computing Company, Inc.
22311 Ventura Blvd., Suite 123
Woodland Hills, CA 91364
(213) 999-1919

Racet Computes
702 Palmdale
Orange, CA 92665
(714) 637-5016

Soft-One
315 Dominion Drive
Newport News, VA 23602
(804) 877-6046

Softside Software
305 Riverside Drive
New York, NY 10025
(212) 866-8058

Software Exchange
2681 Peterboro
W. Bloomfield, MI 48033

Solartek
P.O. Box 298
Guilderland, NY 12084

Surf Computer Services
P.O. Box 3218
North Hollywood, CA 91606
(213) 980-6743

Checksum

A ROM Test Program

BY BOB MCMANN

Here's a diagnostic routine to help you determine whether your read only memories are at fault when your computer fails. If Checksum shows the ROMs are not working properly, you know what needs fixing; and if the ROMs are OK, you know to look elsewhere for the cause of trouble.

You should run Checksum when your system is fully operational. Attempting to test a device that may or may not be working properly without a known starting point is difficult at best. For maximum effectiveness, run Checksum on a known good device. Immediately record the checksums generated in your system documentation either on the schematic next to the IC in question or on a separate maintenance log.

Operation of Checksum is straight forward. (See Figure 1.) The program is entered at $1000; and there is a vectored jump to START. START prompts the user with the title and asks for the starting address of the memory area to be tested. Type in a 4-digit hex starting address such as $E000. When the program asks for an ending address, again enter a hex address — for example, $E3FF.

The program clears the A and B accumulators and loads the index register with the starting address. It then adds the contents of the memory location pointed to by the index register to the A-accumulator and then exclusive or's that same memory location to the contents of the B-accumulator. The pointer value in the index register is incremented and checked to see if it is equal to the end address plus one. If not, the program continues looping until finished. The add's and exclusive or's ignore all carries. The program then displays both checksums and asks if the user would like to run the program again. Typing "Y" returns the program to the beginning to allow testing of additional devices. Typing "N" returns the user to the monitor: $E0E3 in the case of Mikbug and Smartbug; $7283 in the case of Smoke Signal Broadcasting's DOS. Any other character will cause an invalid response message. In that case, resubmit your response.

The program, written in 6800 assembly language, occupies less than 128 bytes of object code. Much of the 128 bytes consists of user prompts and print strings. Because the program used very little memory, the 6800's powerful relative branching and branch-to subroutine instructions are used to advantage. Having two accumulators proves extremely useful; two sums can be generated almost simultaneously with one pointer (the index register). With one accumulator the program would have to compute the sums in separate loops or save and restore the various values. Either alternative would involve additional overhead. In a program of this size, the difference in execution time is unnoticable since we are limited by I/O speed. However, in a large assembly language program of 1000 to 2000 lines, or in a real-time applications, the differences could become appreciable.

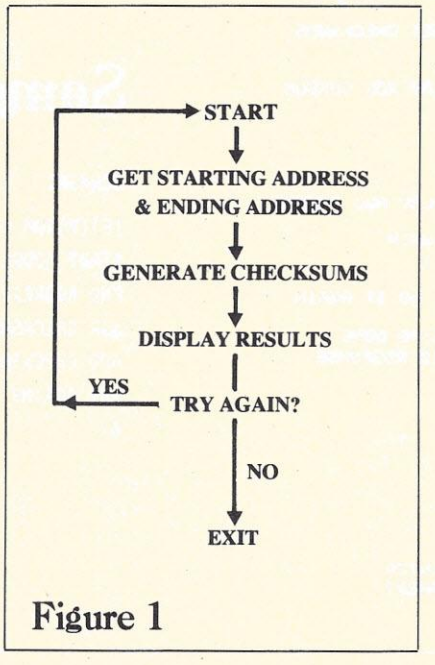


Figure 1

Another powerful software technique used is a vectored jump table for all external program references. For example, PDATA1 is a subroutine that prints a text string using the index register as a pointer. This routine is presently located at $E07E in the Mikbug and Smartbug monitors. Perhaps for some reason you want to change the location of that routine. All that's necessary to modify this program would be to patch the new address of the subroutine in the jump table. The program would then work correctly. If I had referenced PDATA1 directly in the program such as a JSR to PDATA1 at $E07E, then every reference to PDATA1 would have to be changed, either by patching each location where it is referenced or by reassembling the program.

The other subroutines used in this program are BADDR, which builds a hex address; INEEE, which returns an ASCII character in the A-accumulator from the keyboard; BYTE, which builds a hex byte; OUT2H, which outputs a hex byte to the display device; and EXIT, which is the monitor call. All of these subroutines are standard Mikbug/Smartbug subroutines.

The sample run shows a test of the Micro Works U2708 PROM burner routines located at $FCOO to $FFFF. The exculsive or checksum is $E8 and the add checksum is $00. Mikbug and Smartbug monitor results are shown in Figure 2. For other monitors, you'll need to generate your own results.

In my system the program resides in EPROM in high memory on the Micro Works PSB-08 PROM system board along with utility and other test programs. It also resides on disk as a transient command. Thus, if a failure occurs in the disk system I can remove it completely and still use the program located in EPROM. Similarly, if the EPROM board should malfunction, I can easily return to the original Mikbug monitor and use the Checksum program stored on disk. Other test programs are stored in similar fashion.

	XOR	ADD
MIKBUG	E1	03
SMARTBUG	C9	2B
U2708	E8	00

Figure 2

While not intended as a cure-all for everyone's system problems, nor a final word on the subject, this program may save you some time and effort. It can pinpoint trouble areas, such as an EPROM starting to fail, or eliminate those areas from trouble shooting consideration. □

Program Listing

```
                ********************************
                *                              *
                *   CHECKSUM ROM TEST          *
                *   C. 8-78                    *
                *   BY BOB MCMANN              *
                *
                        NAM  CHKSM.TSM
1000                    ORG  $1000
                        OPT  PAG,NOG
                *
1000 20 12              BRA  START
1002 7E E07E PDATA1     JMP  $E07E
1005 7E E047 BADDR      JMP  $E047
1008 7E E1AC INEEE      JMP  $E1AC
100B 7E E0E3 EXIT       JMP  $E0E3
100E 7E E055 BYTE       JMP  $E055
1011 7E E0BF OUT2H      JMP  $E0BF
                *
                ********************************
                *     EQUATES
                *
A002            BEGA    EQU  $A002
A004            ENDA    EQU  $A004
A00E            TEMP    EQU  $A00E
                *
1014 8D 5F      START   BSR  CRLFD    TITLE PROMPT
1016 CE 107B            LDX  #TITLE
1019 8D E7              BSR  PDATA1
101B 8D 58              BSR  CRLFD
101D CE 1094            LDX  #BEG  GET BEGINNING ADDRESS
1020 8D E0              BSR  PDATA1
1022 8D E1              BSR  BADDR
1024 FF A002            STX  BEGA
1027 8D 4C              BSR  CRLFD
1029 CE 10A4            LDX  #END
102C 8D D4              BSR  PDATA1
102E 8D D5              BSR  BADDR GET END ADDRESS
1030 08                 INX    BUMP FOR CORRECT LOOPING
1031 FF A004            STX  ENDA  PUT AWAY
1034 8D 3F              BSR  CRLFD
1036 CE 10C9            LDX  #CHKXOR     XOR CHECKSUM
1039 8D C7              BSR  PDATA1
103B 8D 28              BSR  CHKSUM  GO GET CHECKSUMS
103D CE A00E            LDX  #TEMP
1040 A7 00              STA A 0,X
1042 8D CD              BSR  OUT2H  DISPLAY XOR CHKSUM
1044 8D 2F              BSR  CRLFD
1046 CE 10B2            LDX  #CHKADD
1049 8D B7              BSR  PDATA1
104B CE A00E            LDX  #TEMP
104E E7 00              STA B 0,X
1050 8D BF              BSR  OUT2H   DISPLAY ADD CHKSUM
1052 8D 21      AGAIN   BSR  CRLFD
1054 CE 10E0            LDX  #TRY2  TRY AGAIN
1057 8D A9              BSR  PDATA1
1059 8D AD              BSR  INEEE
105B 81 59              CMP A #'Y    YES, DO IT AGAIN
105D 27 B5              BEQ  START
105F 81 4E              CMP A #'N   NO WE'RE DONE
1061 26 EF              BNE  AGAIN INVALID RESPONSE
1063 20 A6              BRA  EXIT
                *
                *
                *  CHECKSUM GENERATOR     *
                *
1065 FE A002 CHKSUM     LDX  BEGA
1068 4F                 CLR A
1069 5F                 CLR B
106A A8 00   CHKSM1     EOR A 0,X
106C EB 00              ADD B 0,X
106E 08                 INX      BUMP POINTER
106F BC A004            CPX  ENDA   FINISHED?
1072 26 F6              BNE  CHKSM1   NO, ADD SOME MORE
1074 39                 RTS
                *
1075 CE 10EC CRLFD      LDX  #CRLF
1078 8D 88              BSR  PDATA1
107A 39                 RTS
                *
                *  PRINT STRINGS
                *
107B 28         TITLE   FCC  '(E)(P)ROM CHECKSUM TEST'
1092 20 04              FDB  $2004
1094 53         BEG     FCC  'START ADDRESS?'
10A2 20 04              FDB  $2004
10A4 45         END     FCC  'END ADDRESS?'
10B0 20 04              FDB  $2004
10B2 41         CHKADD  FCC  'ADD CHECKSUM IS . . .'
10C7 20 04              FDB  $2004
10C9 58         CHKXOR  FCC  'XOR CHECKSUM IS . . .'
10DE 20 04              FDB  $2004
10E0 54         TRY2    FCC  'TRY AGAIN?'
10EA 20 04              FDB  $2004
10EC 0D         CRLF    FCB  $D,$A,0,0,0,0,4
                        END
    NO ERROR(S) DETECTED

    SYMBOL TABLE:
AGAIN  1052  BADDR  1005  BEG    1094  BEGA   A002  BYTE   100E
CHKADD 10B2  CHKSM1 106A  CHKSUM 1065  CHKXOR 10C9  CRLF   10EC
CRLFD  1075  END    10A4  ENDA   A004  EXIT   100B  INEEE  1008
OUT2H  1011  PDATA1 1002  START  1014  TEMP   A00E  TITLE  107B
TRY2   10E0
```

Sample Run

```
&CHKSM1

(E)(P)ROM CHECKSUM TEST
START ADDRESS? FC00
END ADDRESS? FFFF
XOR CHECKSUM IS. . .E8
ADD CHECKSUM IS. . .00
TRY AGAIN? N
&
```

Structure Your Programs in English

BY REGINALD D. GATES

Structured programming, adopted by many software firms, provides three major advantages:

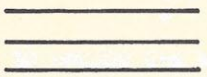
- Once designed, structured programs are easier to code.
- Structured programs are more readily understood and modified.
- Structured programs have fewer errors per line of code than unstructured programs. (In fact, some of them are rumored to have executed correctly the first time.)

You can easily obtain these advantages for your programs by designing their logic structure with English phrases, using a few simple conventions. Program flowcharts will be eliminated, since a readable description of the logic is produced. In addition, you'll be able to code and test your programs in manageable sections, rather than in one large, complex unit.

To support these claims, I'll begin by discussing some program design concepts used in structured programming, then describe how to use English to structure the logic for a program. A non-trivial program will be developed using the suggested conventions.

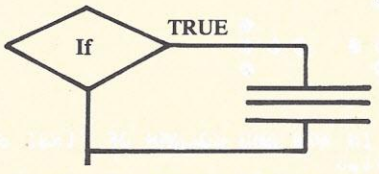
Program design is the logical ordering of operations to produce a desired result. Structured programming asserts that *any* desired result (hence any program) is achieved through the combination of only three types of elementary operations. These "simple" operations, called "constructs", are independent of the program's language and express the logic of the design.

Construct 1: Straightline Execution. Operations are executed one after the other, in the order written.



```
LET A =A + 1
LET B = (A * 17) + 4
```

Construct 2: If–Then. If a condition exists (i.e., a statement is true), perform a *limited* set of operations.



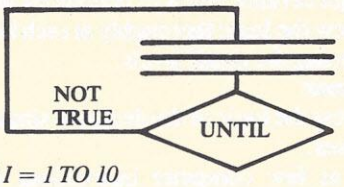

```
IF A1 = B1 THEN C = 1
```

Usually this construct is presented as If–Then–Else, but this is equivalent to the following If–Then constructs:

If condition exists (is true) then_____
If condition does not exist (is not true) then_____

If–Then–Else is very useful, but since it may not be implemented in the language processor for a particular system, we will use only the If–Then construct.

Construct 3: Loop. Repeat a set of operations until a specified condition exists, or a specific statement is evaluated as true.




```
FOR I = 1 TO 10
LET A1 (I) = I * 8
NEXT I
```

To repeat a series of operations, the Loop construct has an implied "branch" back to the beginning of the series. The NEXT statement in BASIC, for example, implies a jump back to the associated FOR statement.

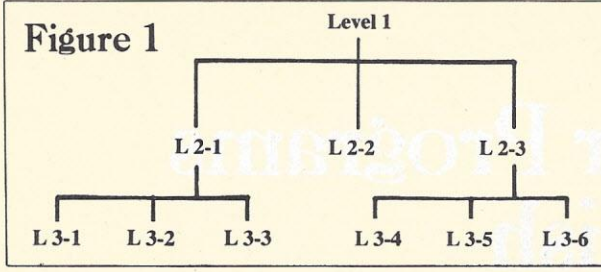
Except for the implied branch in the Loop construct, none of the three operations permit a jump of control flow in the program's design. This constraint results in the often-heard statement that "A structured program has no "GOTOs". The "GOTOs" are missing because only the three elementary constructs outlined above were used in designing the program.

In some situations, it's particularly difficult to implement the Loop construct without using branches. Although the sample program developed later in this article uses GOTOs, the program is structured. The GOTOs represent the implicit branch of the Loop construct.

Elementary operations may be combined into a unit which can be used as an elementary operation elsewhere in the structured program's design. In this way, levels are introduced into the logic design. The units (or operations) at each level are always used within one of the three constructs already defined. Each level is structured within itself.

Although the elementary operations may be combined into units, and these units into more general units, the rule in structured programming is to *proceed from the top down.* Structured programming starts with the desired result and asks "What must we do to get here?" Having determined these operations, they in turn are examined. Each operation is regarded as a result of component operations at a lower level. The lower-level components themselves are then considered as results and analyzed. This structure causes a program to resemble a pyramid with an increasing number of operations at each level. If an analysis resulted in three operations at each of two levels, the resulting program would look something like Figure 1.

Figure 1



This analysis (or decomposition) of the operations continues until the resulting operations are roughly equivalent to computer instructions. Coding the program then becomes a task of translating the design statements into the computer language. All questions of logic should have been resolved in All questions of logic should have been resolved in to the top-down analysis.

Take advantage of structured programming using English by following these conventions:

A. Design

1. Design the program from the top down.
2. Use only the 3 structured programming constructs.
3. Design definite levels of operations into the program.
4. Review the logic thoroughly at each higher level before designing the detail levels.

B. Grammar

1. Express the logic of the design in simple English phrases. phrases.
2. Use as few computer instructions in the phrase as possible.
3. Use only one verb in a phrase.
4. Capitalize the words "IF" and "LOOP".
5. Indent the operations under the control of an If or Loop construct.
6. Put the word "ENDIF" at the end of the operations controlled by an IF. Put "ENDLOOP" following the ones controlled by a LOOP.
7. Align the IF–ENDIF, LOOP–ENDLOOP pairs.

C. Data

1. Keep track of the data names, registers, etc., and what they contain as the design proceeds from level to level.

The next task is to show how these conventions are used to structure a program.

Martin Gardner describes the game called "Tac Tix" in his excellent book *Mathematical Puzzles and Diversions*. This game is played on a square, checker-like board having n squares on a side. Initially all n × n squares are covered by a checker. Two players alternate removing checkers from the board. They may remove 1 to n checkers in a single move, but they may never remove checkers diagonally, or in more than one row or column. If the game is played so that the player who removes the last counter wins, and n is even, the second player can always win. See Figure 2 for a portion of or a Tac Tix game on a 4 × 4 board.

4 × 4 Tac Tix **Figure 2**

Beginning positions	A takes	B takes	A takes	B takes
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	1 2 3 5 6 7 9 10 11 13 14 15 16	1 2 3 6 7 10 11 14 15 16	1 2 6 10 14 16	1 16
	4, 8, 12	5, 9, 13	3, 7, 11, 15	2, 6, 10, 14

The second player always leaves at least one pair of "diagonally opposite" checkers, such as 1 and 16 in Figure 2. The first player can remove only one member of the pair; B

Sample Run

```
   WELCOME TO THE GAME OF TAC-TIX

TRY TO TAKE THE LAST BEAD FROM THE BOARD
THE BOARD HAS 6 ROWS AND SIX COLUMNS
YOU MAY TAKE ANY NUMBER OF BEADS IN A ROW
  OR A COLUMN - NOT DIAGONALLY
WHEN I ASK YOU,TYPE IN THE ROW AND COLUMN OF
THE FIRST BEAD YOU WILL TAKE, THEN THE LAST
THE LAST MUST BE TO THE LEFT OR BELOW THE FIRST
  YOU CAN GO FIRST

HIT CR WHEN READY

GOOD LUCK -  IVE NEVER BEEN BEAT


    C O L U M N S
      1 2 3 4 5 6
R1  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
02  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
W3  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
S4  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
 5  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
 6  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)1,2
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)1,5

  C O L U M N S
    1 2 3 4 5 6
R1  ⊕         ⊕
02  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
W3  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
S4  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
 5  ⊕ ⊕ ⊕ ⊕ ⊕ ⊕
 6  ⊕           ⊕

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)2,4
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)4,4

  C O L U M N S
    1 2 3 4 5 6
R1  ⊕           ⊕
02  ⊕ ⊕ ⊕   ⊕ ⊕
W3  ⊕ ⊕     ⊕ ⊕
S4  ⊕ ⊕     ⊕ ⊕
 5  ⊕ ⊕   ⊕ ⊕ ⊕
 6  ⊕           ⊕

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)4,1
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)4,5

  C O L U M N S
    1 2 3 4 5 6
R1  ⊕           ⊕
02  ⊕ ⊕ ⊕   ⊕ ⊕
W3  ⊕
S4              ⊕
 5  ⊕ ⊕   ⊕ ⊕ ⊕
 6  ●           ●

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)1,6
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)4,6
```

Sample Run continued

```
  C O L U M N S
   1 2 3 4 5 6
R1 ⊕
02 ⊕ ⊕ ⊕   ⊕
W3
S4
 5   ⊕   ⊕ ⊕ ⊕
 6         ⊕

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)2,1
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)2,3

  C O L U M N S
   1 2 3 4 5 6
R1 ⊕
02        ⊕
W3
S4
 5   ⊕
 6         ⊕

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)1,1
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)2,5
SECOND CHOICE BEFORE FIRST
ERROR RE-ENTER
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)1,1

  C O L U M N S
   1 2 3 4 5 6
R1
02        ⊕
W3
S4
 5   ⊕
 6

TYPE IN ROW AND COLUMN OF FIRST BEAD
(R,C)2,5
TYPE IN ROW AND COLUMN OF SECOND BEAD
(R,C)2,5

 AHA - I WON

DO YOU WANT TO PLAY AGAIN (Y OR N)N

I WON  1 GAMES  YOU WON  0

  GOODBYE
READY
```

TABLE 1 DATA SHEET FOR PROGRAM

Field Name	Dim	Description
W1	1	Count of machine wins
W2	1	Count of player's wins
W3	1	Winner indicator (Who flag) 1 = machine 0 = player
B1	36	Board matrix
L1	1	Line counter
V1	1	Valid input flag (1 = on)
R1	1	Player's first row from input
C1	1	Player's first column from input
R2	1	Player's second (last) row input
C2	1	Player's second (last) column input
C3	6	Array of player's choices
R3	1	Internal row pointer
R4	1	Internal column pointer
S1	1	Sum of the board entries (0 = winner)
Q1$	1	Input if player wants to quit

then removes the second member and wins. The only difficulty B faces is determining the diagonally opposite pairs.

There is a simple technique to generate these pairs. Assume you're playing on a 6 × 6 board. Number the board from 1 to 36 and then form the pairs of unique numbers that sum to (36 + 1). The pairs are listed below.

(1, 36)	(2, 35)	(3, 34)	(4, 33)	(5, 32)	(6, 31)
(7,30)	(8, 29)	(9, 28)	(10,27)	(11, 26)	(12, 25)
(13, 24)	(14, 23)	(15, 22)	(16, 21)	(17, 20)	(18, 19)

The first entry in each pair is "diagonally opposite" the second, i.e., the first is not in same row or column as the second. When A makes his move, B replies by removing the corresponding entries from the affected number pairs. If A removes (29), B replies (8). If A responds (16, 17, 18), B removes (21, 20, 19). Note that the moves determined in this manner conform to the game's rules for removing checkers from the board.

Let's design a structured program to play the game as the second player, using this winning strategy. As required by the conventions, we begin at the highest level and work down.

Every computer program seems to require attention as soon as the program is loaded. You may have to set some data fields to a constant value, and, for this program, you may want to print out some instructions to the player. "*Initialize*" is a pretty safe bet for your first operation.

"Initialize" may be the last operation coded. Most of its entries will be developed from the data sheet called for by C of the conventions.

You may want the game to be re-playable (to play it over and over again until the player asks to quit). This repetition suggests the Loop construct "*LOOP until the player wants to quit.*"

When the player does quit, perhaps the program should display a "box score". "*Print count of games won and lost.*" At this point, you'll have the following design:

Level 1
Initialize
LOOP until player wants to quit
ENDLOOP
Print out count of games won and lost
Done

The next task for this level is to determine what operations belong under control of the Loop construct. If you start a new game, some data items left from the previous game may need to be reset. Then you'll actually play the game and adjust the winner's total.

Level 1
Initialize
LOOP until the player wants to quit
  Set up for new game
  Play the game
  Increment the winner's count
ENDLOOP
Print out count of games won and lost
Done

Upon review, it's apparent that the design is incorrect. You have not asked the player if he wants to quit. The corrected logic will look like this.

Level 1
Initialize
LOOP until player wants to quit
  Set up for new game

```
    Play the game
    Increment the winner's count
    Ask if the player wants to quit
  ENDLOOP
  Print out count of games won and lost
  Done
```

Although this may look trivial, you have established some significant characteristics for operations. "Play the game" will not have to concern itself with any initialization, but it must establish who (machine or player) won the game. Several data fields have been determined and entered on the data sheet: the count of machine wins, the count of player wins, the flag set if the player wants to quit and the winner indicator.

Let's now design "play the game" in English. Since the players alternate *until* one wins, a Loop construct is suggested.

```
LOOP unitl there is a winner
ENDLOOP
```

Your opponent will go first, so it's reasonable to build the operations controlled by this Loop from the player's point of view. First, display the board to him and then obtain his move. Next, the board will be adjusted by removing his suggestions. Then check to see if he won. (He shouldn't, but let's play safe.) This gives you the following:

```
Print out board
Obtain player's move
Adjust board
Set who won flag to player
Check for a win
```

You should make the machine's move next, but only if the player did not win. After making the machine's move, check to see if it won. Your final design looks like this:

Level 2 — Play the Game

```
LOOP  until there is a winner
   Print out board
   Obtain player's move
   Adjust board
   Set who won flag to player
   Check for a win
   IF there is no winner
      Make machine's move
      Set who won flag to machine
      Check for a win
   ENDIF
ENDLOOP
```

Before you go on to expand the Level 2 operations into their Level 3 components, decide how to represent the board internally, how you want it displayed and how the player will indicate his moves. A case could be made for considering the board as a two-dimensioned array, 6 × 6. Since you choose your responses on a 36 number basis, though, let's represent the board as a single-dimensioned array, 36 entries in size. If an entry is 0, the associated checker has been removed. If it is 1, the checker is present. If all the entries are zero, someone has won the game.

When the board is displayed to the player use a row, column format with appropriate headings. The Level 3 entry "Print out board" can now be designed.

Level 3 — Print Out Board

```
Print a blank line
Print column headings
Set row counter to 1
LOOP until row counter is greater than 6
   Print row heading
   Print all entries in row
   Increment row counter
ENDLOOP
Print a blank line
```

To complete this line of development, let's design "Print all entries in row" for the above Level 3.

Level 4 — Print All Entries in Row

```
Set column counter to 1
LOOP until column counter is greater than 6
   Calculate an index = column counter + [(row counter
     – 1) * 6]
   IF board entry (index) = 0
      Print two blanks
   ENDIF
   IF board entry (index) = 1
      Print asterisk and one blank
   ENDIF
ENDLOOP
```

The preceding operations seem close enough to BASIC commands that no further analysis is necessary. The next step is to design the Level 3 entries for the rest of the program and develop their respective components. Then, after a thorough review of the design logic at each level, assign data names to the elements developed for article C of the conventions. (See Table 1.) Now (at last) you're ready to code the program.

It is not necessary (and not desirable) to code the whole program at once. A lower level communicates with a higher level by setting switches (flags) or modifying the data in some way. A higher level never executes a portion of a lower level's code. You can code short "dummy" routines to simulate the effects of the lower level on the data and use them to assist in checking out the logic of the higher levels. For example, the editing of the player's input will take a bit of tedious work, while what you really want to test thoroughly is the logic of modifying the board and calculating the machine's responses. Code a dummy edit routine, and, as long as you're careful to make the input according to the edit rules, this routine will let you test the more interesting parts of the program. When the major sections are checked out, the operations that replace the dummy section are coded.

As you code the program, note the line numbers that correspond to the LOOP, ENDLOOP, and IF verbs next to the English statements in the design. This reference provides a valuable roadmap from the logic design to the actual program operation.

Once the program is completely coded and tested, the annotated design and the data sheet provide excellent program documentation.No flowchart is necessary, since the logic is fully expressed by English statements. The design, data sheet and program listing (if hardcopy is available) are filed together for future use.

But what of the "bottom line" — the time and accuracy of the program development process? Here are the results:

- To develop the English language logic design took 4 hours.
- To code the whole program and remove syntax errors took 3.5 hours.
- Only one logic error was encountered — see statements 6910 and 6970. I multiplied the column minus one by 6 and added the row, instead of vice versa.

The conventions used are simple and the design philosophy is easy to follow. Try structuring your next program in English. You'll like the results. □

Program Listing

```
10 REM  TAC-TIX  04-28-78
20 REM
30 GOSUB 200
40 REM -LOOP UNTIL PLAYER QUITS
50 REM
60    GOSUB 1000
70    GOSUB 2000
80    IF W3=0 THEM W2=W2&1
90    IF W3=1 THEN W1=W1&1
92    PRINT ""
94    PRINT "DO YOU WANT TO PLAY AGAIN ";
100   INPUT "(Y OR N)",Q1$
110   IF Q1$="Y" THEN 40
120REM-ENDLOOP
140 PRINT ""
145 PRINT "I WON ";W1;" GAMES";
150 PRINT "  YOU WON ";W2
160 PRINT ""
170 PRINT "  GOODBYE  "
199 END
200 REM
210 REM - INITIALIZE
215 REM
220 DIM B1(36),C3(6),Q1$(1)
225 Q1$=Q1$&"N"
230 W1=0
235 W2=0
240 W3=0
245 PRINT ""
250 PRINT "  WELCOME TO THE GAME OF TAC-TIX"
255 PRINT ""
260 PRINT "TRY TO TAKE THE LAST BEAD FROM THE BOARD"
265 PRINT "THE BOARD HAS 6 ROWS AND SIX COLUMNS"
270 PRINT "YOU MAY TAKE ANY NUMBER OF BEADS IN A ROW"
275 PRINT "  OR A COLUMN - NOT DIAGONALLY"
280 PRINT "WHEN I ASK YOU,TYPE IN THE ROW AND COLUMN OF"
285 PRINT "THE FIRST BEAD YOU WILL TAKE, THEN THE LAST"
287 PRINT "THE LAST MUST BE TO THE LEFT OR BELOW THE FIRST"
290 PRINT "  YOU CAN GO FIRST"
295 PRINT ""
315 INPUT "HIT CR WHEN READY",Q1$
320 Q1$="N"
325 PRINT ""
330 PRINT "GOOD LUCK -  IVE NEVER BEEN BEAT"
399 RETURN
1000 REM INITIALIZE FOR GAME
1005 REM
1010 W3=0
1015 S1=36
1020 FOR I=1 TO 36
1025   B1(I)=1
1030 NEXT I
1035 V1=0
1040 FOR I=1 TO 6
1045   C3(I)=0
1050 NEXT I
1199 RETURN
2000 REM - PLAY GAME
2005 REM
2010 REM -LOOP UNTIL THERE IS A WINER
2015 REM       4000=PRT BOARD
2016 REM       6000=GET PLAYERS MOVE
2017 REM       8000=ADJ BOARD
2018 REM       10000=CHECK FOR WINNER
2010    GOSUB 4000
2030    GOSUB 6000
2040    GOSUB 8000
2045    W3=0
2050    GOSUB 10000
2060    IF S1()0 THEN GOSUB 2100
2075    IF S1()0 THEN 2010
2080 REM-ENDLOOP
2099 RETURN
2100 REM - MOVE FOR MACHINE
2105 REM
2110 GOSUB 12000
2120 W3=1
2130 GOSUB 10000
2132 IF S1=0 THEN PRINT ""
2135 IF S1=0 THEN PRINT " AHA - I WON"
2199 RETURN
```

Program continued on next page

Program Notes

- My system is a Digital Group Z-80 system with 26K of memory. The Tac Tix program was originally developed under Version 1.0 of Maxi-Basic from the Digital Group. Currently it is running under Maxi-Basic 2.0.
- Indentation is used to set off the statements under control of LOOP operations. It was not possible to use indentation the same way to set off IF statements.
- Maxi-basic permits me to drop the GOTO operand in an IF-THEN statement.
- If there were multiple operations under control of an IF construct, either the IF test was repeated or the operations were placed in a section by themselves.
- The start and end of a LOOP is indicated by Remark statements when the LOOP is not a FOR-NEXT loop.

Note: I use a Baudet teletype as my hardcopy device. The character set on my printer does not contain all the special characters necessary to list a BASIC program listing.

& = +
+ = *
) = greater than sign whenever) appears alone
(= less than sign whenever (appears alone
() = not equal to whenever there is no term inside the parentheses

```
4000 REM PRT BOARD
4005 REM
4010 PRINT ""
4020 PRINT "  C O L U M N S"
4025 PRINT "  ";
4030 PRINT " 1 2 3 4 5 6"
4035 REM -LOOP UNTIL I)6
4040 REM      4200=ROW HEADINGS,4400=ROW LINES
4050   FOR I=1 TO 6
4055     GOSUB 4200
4060     GOSUB 4400
4070   NEXT I
4075 REM-ENDLOOP
4080 PRINT ""
4199 RETURN
4200 IF I=1 THEN PRINT "R1";
4205 IF I=2 THEN PRINT "02";
4210 IF I=3 THEN PRINT "W3";
4212 IF I=4 THEN PRINT "S4";
4225 IF I=5 THEN PRINT " 5";
4227 IF I=6 THEN PRINT " 6";
4230 RETURN
4400 REM PRT A LINE
4405 REM -LOOP UNTIL J)6
4415   FOR J=1 TO 6
4420     K=J&(I-1)⊕6
4425       IF B1(K)=0 THEN PRINT "  ";
4430       IF B1(K)=1 THEN PRINT " ⊕";
4435   NEXT J
4440 REM -ENDLOOP
4445 PRINT ""
4499 RETURN
6000 REM OBTAIN PLAYERS MOVE
6005 V1=0
6010 REM-LOOP UNTIL VALID INP
6012 REM      6200=GET FIRST PAIR,6400=EDIT
     FIRST PAIR
6015     GOSUB 6200
6020     GOSUB 6400
6030     IF V1=0 THEN PRINT "ERROR RE-ENTER"
6035     IF V1=0 THEN 6010
6040 REM-ENDLOOP
6045 V1=0
6050 REM-LOOP UNTIL VALID SECOND PAIR
6055     GOSUB 6600
6060     GOSUB 7000
6070     IF V1=0 THEN PRINT "ERROR RE-ENTER"
6072     IF V1=0 THEN 6050
6075 REM-ENDLOOP
6080 GOSUB 6800
6099 RETURN
6200 REM OBTAIN FIRST PAIR
6205 REM
6210 PRINT "TYPE IN ROW AND COLUMN OF FIRST BEAD"
6215 INPUT "(R,C)",R1,C1
6299 RETURN
6400 REM EDIT FIRST PAIR
6405 REM
6410 V1=1
6420 R3=R1
6430 GOSUB 6500
6435 R3=C1
6430 GOSUB 6500
6435 R3=C1
6440 IF V1=1 THEN GOSUB 6500
6445 IF V1=1 THEN GOSUB 6550
6499 RETURN
6500 REM UTILITY RANGE CHECK - VALUE IN R3
6510 IF R3(1 THEN V1=0
6515 IF R3)6 THEN V1=0
6520 IF V1=0 THEN PRINT "R OR C LESS 1 OR GR 6"
6525 RETURN
6550 REM BOARD CHECK
6555 R5=C1&(R1-1)⊕6
6560 IF B1(R5)=0 THEN V1=0
6565 IF V1=0 THEN PRINT "BEAD DOES NOT EXIST"
6599 RETURN
6600 REM OBTAIN SECOND PAIR
6606 PRINT "TYPELIN ROW AND COLUMN
     OF SECOND BEAD"
6615 INPUT "(R,C)",R2,C2
6699 RETURN
6800 REM COMPUTE THE PLAYERS ENTRIES
6805 FOR I=1 TO 6
6810   C3(I)=0
6815 NEXT I
6820 R5=1
6825 R3=R1
6830 R4=C1
6835 IF R1=R2 THEN GOSUB 6900
6836 R5=1
6840 IF R1()R2 THEN GOSUB 6950
6899 RETURN
6900 REM-LOOP UNTIL INTERN COL IS ) END COLUMN
6910     C3(R5)=R4&(R3-1)⊕6
6915     R4=R4&1
6920     R5=R5&1
6925     IF R4(=C2 THEN 6900
6930 REM-ENDLOOP
6949 RETURN
6950 REM-LOOP UNTIL INT ROW ) LAST ROW
6970   C3(R5)=R4&(R3-1)⊕6
6975   R5=R5&1
6980   R3=R3&1
6985   IF R3(=R2 THEN 6950
6990 REM-ENDLOOP
6999 RETURN
7000 REM EDIT SECOND PAIR
7005 REM
7010 V1=1
7015 R2=INT(R2)
7020 C2=INT(C2)
7025 R3=R2
7030 GOSUB 6500
7035 R3=C2
7040 IF V1=1 THEN GOSUB 6500
7045 IF V1=1 THEN GOSUB 7100
7099 RETURN
7100 REM PAIR MATCH EDITS
7110 IF R1=R2 THEN GOSUB 7300
7120 IF R1()R2 THEN GOSUB 7500
7199 RETURN
7300 REM ROWS ARE =
7310 IF C2(C1 THEN V1=0
7315 IF V1=0 THEN PRINT "SECOND CHOICE
     BEFORE FIRST"
7399 RETURN
7500 REM ROWS ARE NOT = COLUMNS BETTER BE
7505 IF C1()C2 THEN V1=0
7510 IF V1=0 THEN PRINT "SECOND CHOICE
     BEFORE FIRST"
7599 RETURN
8000 REM ADJUST BOARD FOR PLAYER
8005 REM
8007 REM-LOOP UNTIL I)6
8010 FOR I=1 TO 6
8015   IF C3(I)()0 THEN GOSUB 8100
8020   NEXT I
8025 REM-ENDLOOP
8099 RETURN
8100 K=C3(I)
8105 IF B1(K)=0 THEN C3(I)=0
8110 IF B1(K)()0 THEN B1(K)=0
8199 RETURN
10000 REM UTILITY CHECK FOR WINNER
10002 S1=0
10005 REM-LOOP THRU BOARD
10010 FOR I=1 TO 36
10015   S1=S1&B1(I)
10017   NEXT I
10020 REM-ENDLOOP
10099 RETURN
12000 REM MAKE MACHINES MOVE
12005 REM-LOOP
12010 FOR I=1 TO 6
12015   K=37-C3(I)
12025   IF K(37 THEN B1(K)=0
12030   NEXT I
12040 REM-ENDLOOP
12099 RETURN
READY
```

COMPUTER CHESS

HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

A Review of Chess Devices and Programs

(with an eye toward selecting one as a holiday gift.)

Varieties of computer chess products have, like Mrs. Wiggin's cabbage patch, pushed their way right out of the garden. And mostly during the past year.

The two stand alone chess devices that are currently the most popular on store shelves are CHESS CHALLENGER and BORIS. They have reached that high-level water-mark by garnering all of the early publicity on such things. CHESS CHALLENGER is the real pioneer, and was first to appear on the market. So far it has been setting all the trends and leading the way with BORIS close behind. Chess devices with less stature and simpler in hardware are COMPU-CHESS, CHESSMATE, CHESS CHAMPION and CHESS MASTER. (The latter, only a problem solver.)

Programmed chess exists in forms of cassettes, disks or cartridges. They are run on microcomputers or TV-interfacing machines. The single most popular member in this group is SARGON which earned its fame by easily winning its very first public micro-chess tournament in Jan. of '78, against a handfull of other programs at San Jose. Later, in December of '78, it went to the ACM chess tournament in Washington to flex its little muscles against the giants of IBM, Control Data, Sperry Univac, and other big-boy mainframes. Sargon didn't do too badly either, then. Other chess tapes besides SARGON, that are now available, include MICRO-CHESS, 8080 CHESS, TCD CHESS, Z CHESS and MYCHESS.

The only cartridge (a replaceable ROM IC board) on the scene at the moment is ATARI CHESS, which must be played on Atari's own Video Machine.

Pricewise, most expensive of these items are BORIS and CHESS CHALLENGER which average around $300. (Deluxe models of both go up to about $1,000 while economy models go down to about $100). Other chess game devices sell in the $100 range.

Cassettes all sell in the $25 range. If your gift recipient already owns a microcomputer any of the programs designed for his machine should satisfy his gaming instincts.

ATARI's video cartridge goes for about $35 but you will have to buy an ATARI machine (that converts a TV screen into a chessboard) for about $150.

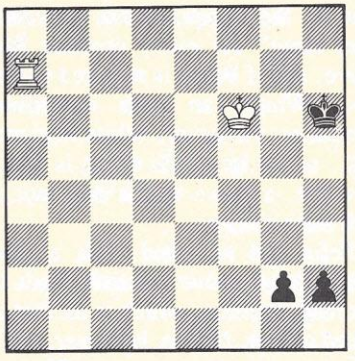
SARGON, supposedly, is the best microcomputer chess program around. We haven't as yet seen the *new* BORIS or the *new* CHALLENGER so we can't offer any personal reactions to them. However, if you listen to the tub-thumping coming from both companies you should be impressed. Drop in to some of the chess studios or department stores where they are on display, and sneak in a trial game yourself. Salespeople in the stores are usually happy to let you have a go at the machines. Chess studios, where you can play quietly and without too much background noise, charge a modest fee for playing a game. The fee is quite reasonable, considering that they have to pay rent too.

ATARI is a nice idea — not because it plays better chess (although the company claims it has beaten old BORIS and old CHALLENGER) but because ATARI offers around 30 other game cartridges. If you invite guests to the house some night and want to entertain them you can drop in one of ATARI's games. Nice thing about video games is that everyone does a lot of vocalizing and everyone takes part in the conflicts going on at the TV screen. We haven't seen the Atari machine yet — but it does sound like a nifty gadget. It is niftier, though, to carry CHALLENGER or BORIS under the arm as you travel. They make delightful traveling companions to lighten your journey.

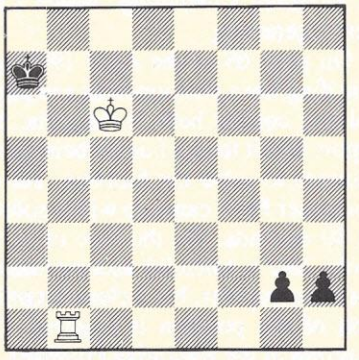
When choosing one of the above products as a gift (and try to buy the **latest** version available) consider the playing abilities of the recipient. A good chess player without a computer would welcome either CHALLENGER or BORIS. Which of these two is the better player? Suggest you watch upcoming PC Computer-Chess columns which reports continuing clashes of these devices against each other in match play or against PC readers. But don't overlook the other machines which admittedly play weaker chess.

continued on next page

A grand illusion



The Moravec Chess Problem shown last month, contained an unfortunate error. One of Black's two Pawns was omitted. With only one lousy Pawn, there is no hope for Black and, hence, no problem. The correct positions, with White on the move (and trying for a draw):



Directory of Commercial Chess Products

STAND ALONE CHESS DEVICES:

Fidelity Electronics
8800 NW 36th St.,
Miami, FL 33178
CHESS CHALLENGER Series

Chafitz Company
1055 First Street
Rockville, MD 20850
BORIS Series

JS&A National Sales Group
One JS&A Plaza
Northbrook, IL 60062
CHESS CHAMPION

Master Distributors
1000 16th St., NW
Washington, DC 20036
CHESS MASTER (A problem solver)

Data Cash Systems
699 4th St., NW
Largo, FL 33540
COMPUCHESS

PROGRAMMED CHESS ON CASSETTE

Personal Software Co.,
592 Weddell Drive
Sunnyvale, CA 94086
MICROCHESS (For PET, APPLE, TRS-80)

Hayden Publishing Co.,
50 Essex Street
Rochester Park, NJ 07662
SARGON (For, PET, APPLE, & TRS-80)

Commodore Co.
3330 Scott Blvd.
Santa Clara, CA 95050
COMMODORE CHESSMATE (For PET)

TCD Inc.
PO Box 58742
Houston, TX 77058
TCD CHESS (For SOL)

SOFTWARE Association
PO Box 58365
Houston, TX 77058
"Z CHESS" (For TRS-80)

DISKS

David Kittinger
2431 Lyvona Lane
Anchorage, AL 99502
MYCHESS (For the CROMEMCO)

CARTRIDGES

ATARI, Inc.
(Div. of Warner Communications)
1265 Borregas Ave
Sunnyvale, CA 94086
CHESS FOR ATARI MACHINES

They are nice gifts (at less than $100) for beginners and kids (except for some like Joel Benjamin who is a 12-year-old-kid, plays above the 2000 level and can beat the checkered pants off most adults). Incidentally, opinions from some noted educators in the past, have stated that if you want your kid to do well at school, get him interested in chess at an early age. We have yet to meet a good chess player who hasn't had an impressive IQ.

If your gift recipient already owns a microcomputer, then buy him a whole batch of different chess cassettes. He'll have a ball testing the programs against each other and playing against them himself. He's sure to keep in touch with you, letting you know how he's doing with your gift. For long-remembered gifts, this one seems like a good candidate.

Producers of the above items are listed nearby. Write to them for more literature and inquire about prices and latest models. Items on the market which are not listed here were not reported to us in time to make this issue. If any have been left out, a quick note will assure their being added to a supplemental list coming out in a few months.

Further Adventures of Sargon

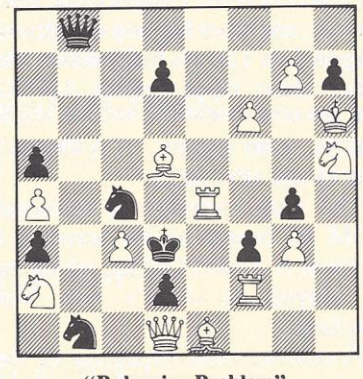
(The following item was received from Ray Ratke, 3822 N. 75th St., Milwaukee, WI 53216)

I recently acquired both a TRS-80 and the Sargon chess cassette, and have been catching up on the chess columns in *Personal Computing*, which I find very interesting.

On page 69 of the April 1979 issue you diagram a position from a problem-solving contest held in Bulgaria. You report that it took a human being seven minutes to solve the problem, but that computer Felix came up with a solution in 30 seconds. On the face of it, this looks like a splendid accomplishment for the computer, but a closer examination of the position is required. (See diagram of the Bulgarian Problem).

An experienced human problem solver sees at a glance that the position is what is called a "complete block"; that is, the composer has provided a "set mate" for every possible Black move, and if Black is required to move first, White can mate immediately thereafter. However, White is to move first, so all he needs to do is find, if possible, a move which does not disturb the set mates.

Felix did not find such a move, although his move certainly leads to a winning position, which is all that was asked of him. Notice, however, that the solution you give on page 70 is not accurate: after Black responds 1. - -, Q X N, White is in check and this must be answered, so that your "2. Q X N mate" is not legal.



"Bulgarian Problem"
White to play and win

To see how Sargon would handle this problem, I had it play white at each of the six "look-ahead" levels, and discovered several things of interest:

At look-ahead 2, Sargon duplicated Felix's first move.

At look-ahead 5 and 6, Sargon moved 1. g7-g8(=Q) and announced "Mate in 2 moves.".

At look-ahead 1, Sargon also moved 1. g7-g8(=Q) but did not announce mate.

At look-ahead 3 and 4, Sargon moved dl-cl and announced "Mate in 1 move"!! Beautiful, charming, delightful, exquisite! Sargon seemingly recognized the blocked position and selected a waiting move that even permitted several "added" mates.

The question to be asked now is: How can Sargon play better at look-ahead 3 & 4 than at 5 & 6? Sargon bettered its performance while trying to solve a different problem I had set up. This was Problem No. 271 on page 212 of the book "Sam Loyd and His Chess Problems" (Dover Publications, Inc.). At look-ahead 3:

Sargon (White)	Human (Black)
1. e1 - e3	1. g1 - h3 check
2. f2 - g3	2. h3 - g1

Sargon avoided the stalemate on both of the first two moves. Unfortunately, he did not find the mate in three moves as required, and in fact fell from grace by permitting a draw in a won position by repetition of moves: the same sequence of two moves was duplicated at moves 3 & 4 and at 5 & 6.

When Sargon played White in Problem 422 on page 298 of "Sam Loyd and His Chess Problems", several unusual circumstances arose. At look-ahead 5:

Sargon (White)	Human (Black)
1. e2 — g3 check, announcing "Mate in 1 Move". This is not correct.	1. e4 - d3

2. e6 — c8, announcing "Mate in 1 Move", which is correct. Thus Sargon found a "cook" in a problem published originally in 1958, and which may have gone unnoticed for 120 years.

Another flaw in the Sargon program is that it does not provide for the possibility of "underpromotion". When a pawn reaches the eighth rank it may, indeed it must, be promoted to some other piece except another king or pawn. Usually it is best to promote to a queen, but rarely it may be better to underpromote to a rook, bishop or knight.

Thus when Sargon played White at look-ahead 3 in Problem 6 on page 12 of "Sam Loyd and His Chess Problems," the first move was 1. a3 — g3, announcing mate in 1 move. Black is constrained to play 1. —, e2 — e1, whereupon the program automatically promoted the pawn to queen. Almost simultaneously, Sargon moved 2. g3 — g2 and announced "Checkmate. I win." Now here is an instance where underpromotion is preferable: underpromoting to a knight averts the immediate mate, and while Black is still in dire straits, Sargon should nevertheless offer the option to Black.

On occasion when I have set up a problem for Sargon to solve (that is, when I want to "analyze a position") Sargon has been a little petulant and thrown a monkeywrench in the proceeding. I discovered that if I set up the position so that I move first, I do not have any trouble. Since it is customary for White to move first in problems set by problem composers, it is necessary, of course, to modify the position so that when White makes his first move the position is the same as the diagrammed book problem. Thus I enter all pieces as diagrammed with the exception of the position of any single convenient Black piece; this I enter on any convenient square from which it may be moved to the diagrammed position. Then I move it as my first move to its proper diagrammed position, and the position is set up properly with the computer to make its first move. Keep the knights hopping!

The positions of the three problems from "Sam Loyd and His Chess Problems" mentioned above are:

Problem #271 White: K at f2, R at e1, N at d4
Black: K at h1, N at g1, P at h2
White to move and mate in 3

Problem #422 White: K at h1, Q at e6, R at f1, B at e5, P at d5, P at d6
Black: K at e4, P at e3, P at f2
White to move and mate in 3

Problem #6 White: K at h1, Q at a3
Black: K at f1, P at e2
White to move and mate in 5

ATARI "PRODUCES"

Had a recent conversation with ebullient Larry Wagner out in California. Larry, formerly with Atari Video Company (and one of the original team members who designed the video game) now heads VOTAN of Hayward, CA. VOTAN is involved in digital speech processing: an exotic technique for voice recognition. The VOTAN device recognizes 300 different words, grunts or growls that have been input by any operator. When the operator is busy sorting mail, for example, or typing a letter, he or she simply utters one of the 300 vocalizations into a headset. The voice board, in response, then stimulates a computer and another desired operation is performed.

More importantly for chess, though, is the fact that Larry is the author of Atari's long-awaited chess cartridge which was announced more than a year ago and which, at this writing, still hadn't made an appearance. We asked Larry to explain the current status of Atari chess, — and why the delay?

"First of all, " said Larry, "Let me say that Atari's Chess Cartridge will finally be in the stores around November. We've had all sorts of technical problems and delays but everything has finally been cleared up. The cartridge, of course, can run only on the Atari machine which sells for anywhere from $140 to $170 depending on where you get it. Compared to some of the other video game-playing machines, though, Atari is a lot cheaper. It doesn't have a keyboard — just joysticks. Officially the device is the 'Atari Video-Computer System.' Although it uses the word

computer' it isn't really a computer at all — it is a computer-based TV-game-playing system. But look at what you can do with Atari. There are now approximately 30 different interchangeable cartridges on the market that can be obtained for the Atari machine. These cartridges include games like TANK, BASEBALL, FOOTBALL and so forth. Atari is heavy on sports, which sell well. However, Atari offers other cartridges like MATH, ARITHMETIC DRILLS, SPELLING PRACTICE and so forth besides other games like STAR TREK. Most of these cartridges sell for $19.95. The new CHESS cartridge will sell for $39.95 because it's something special, has taken a lot of research and work on our part and is a pretty good product.

"On the playing ability of Atari's CHESS I would say that it is somewhere in the Class C ratings. The program itself resides in 4K bytes of ROM and uses only 128 bytes of RAM inside the video computer system. Atari is built around a 6502 microprocessor running at 1.2 MHz. The user can select one of ten different time levels of play from five seconds to 24 hours. In laboratory tests we have been able to beat both the existing BORIS and CHESS CHALLENGER 10 (as of August 1979).

"There is some talk among some chess people here like John Larkins, Allen Benson and myself about again running those 'open-to-all' microcomputer chess tournaments that we ran last year in San Jose. There's a pretty good chance that it will, indeed, come off. I intend to shortly put my cartridge into the machine and run it against SARGON II. I've spent almost a year-and-a-half on that chess cartridge and I do believe that it plays one heck of a game and will beat many programs."

A nod of welcome, then to the arrival of Atari, the chess whiz (hopefully). More information and documented games will be forthcoming, said Larry as the WATS line clicked us off. He did mention the nice California weather.

The astounding proliferation of TV-based "computer" games can be seen from Atari's figures: over 1,000,000 units in hands of consumers, "and growing all the time."

Chess matching

John Urwin, of 1537 Argyle Ct., San Jose, CA 95132, informs us that he and some friends, are running unbiased evaluation chess matches for *all* chess programs and machines. The matches, says John, will be staged against rated human players as well, to get a good line on the playing ability of the various programs. **Anyone** interested in sending a program or machine for evaluation, (and the match is open to **everyone,** not only to commercial projects,) is invited to contact John for further information. John has also promised to send along documentation of all the games played with expert evaluations and annotations to be published in this column. In his letter, he writes: "I have been playing chess for just over three years. I have been a USCF member for less than one. My unofficial rating is 1275 but in the last USCR tournament (a five round Swiss) my results were three wins and two draws. The three wins were against a 1450, 1475 and 1175 rated players. The drawing players were rated at 1445 and 1425. Senior Master George Kane, a Memorex Chess Club member is helping me. I belong to *three* chess clubs: Memorex Chess Club; Santa Clara Chess Club and the recently launched Cromemco Chess Club. As a production supervisor at Cromemco I am involved mostly in the use of Z-80 Assembly Language programming. I have worked with Dave Kittinger of "MYCHESS" which was developed for the CROMEMCO system. Working with Dave has taught me the difficulty in creating a good chess program. My small contribution to MYCHESS was to expand its book openings. Although I have had a part in writing MYCHESS I assure you it will in no way bias me away from other programs. If any machines or programs beat MYCHESS (and I'm sure many can) I will be happy to say so and point out where one program went wrong and the other didn't."

On Parting

(An explanation of why PERSONAL COMPUTING has withdrawn its support of the "Microchess Tournament".)

Don Gerue's "Microchess" tournament started with the declaration that it was going to be a friendly contest open to all chess programs, both commercial and amateur. We all felt, at the time, that such a tournament would provide a valuable service in the field of microcomputer chess — as indeed it did — and so we lent the support of our magazine to Mr. Gerue's tournament.

Recently, however, Mr. Gerue announced a change in the direction of his activities. His Microchess Tournament was to become an enterprise restricted to commercial products only. We have no quarrel with Mr. Gerue's desire to change the format of his tournament. However, our journalistic integrity demands that we remain neutral so we withdrew our official support of his tournament. When the contest was first launched and was open to all comers, we were willing to support the tournament as a venture that would promote the whole field of microcomputer chess as well as the interests of our readers. To lend official support to a commercial tournament, however, might suggest bias on our part in covering other commerical aspects of microcomputer chess, and would not serve the interests of our readers. Furthermore, official support by PERSONAL COMPUTING of the tournament would tend to give our "seal of approval" to whichever commercial program happened to emerge the winner.

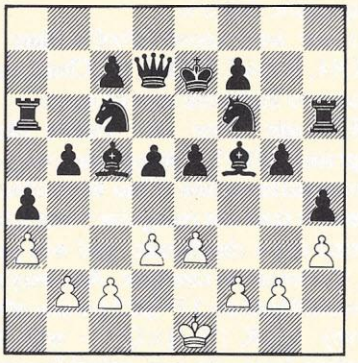
For those reasons, we have withdrawn both official and financial support of Mr. Gerue's Microchess Tournament. Mr. Gerue has worked long and hard in the microcomputer chessfield, and we join with many others in congratulating him and thanking him for his past efforts. We wish him and his tournament the best.

Berating the rating system

"Mr. Ratliff's chess program rating test with the Bloss method in your September issue is certainly very interesting and a step in the right direction," writes Frieder Schwenkel (a professor of computing Science of Woehrenweg 8, 2090 Winsen-Lassroenne, West Germany.) "The results of this test, however, should be viewed with caution for several reasons.

"First, the method is not a test of general playing strength, but of the subject's ability to solve mate-in-'n' problems with positions taken from practical play. With human subjects, this method works quite well, because their performances on various aspects of the game (opening, middle game, mating attack, end game, etc.) are usually closely correlated. For chess programs, of course, this is not true.

"I don't think anyone watching the following funny little game would be willing to concede a 1400 rating for the



"Test Diagram"

black player. White is giving odds of Q, 2R, 2B and 2N, playing with K+8P alone:

1. Kdl, e5 2. Kel, d5 3. Kd1, Nc6 4. a3, Kd7 5. h3, Bc5 6. e3, Nf6 7. d3, Kd6 From now on, White simply continues moving his K back and forth between el and d1, while Black is making the following moves: 8. . Bf5 9. . Qd7 10. . Ke7 11. .b6 12. . g6 13. . Kd6 14. . a5 15. . Ra6 16. . Ke6 17. . h5 18. . Rh6 19. . Kd6 20. . a4 21. . b5 22. . Ke6 23. . Kd6 24. . h4 25. . g5 26. . Ke6 From now on, Black keeps rotating his K: d6, e7, e6, d6, e7, . . . leading to a draw by repetition on the 38th move.

Believe it or not, in the "Test" Diagram Black is Microchess 2.0 on the PET (or the Commodore Chess Mate), set to its maximum playing level. (At less than maximum, the program actually does better on this test, because it is recklessly throwing away its pawns, opening up the position.)

"Secondly, for chess programs the parameter 'n' (no. of moves leading to mate) in the Bloss test is obviously quite critical, whereas for humans, it is not (because of the close correlation of their problem-solving ability for different values of 'n'). Hence, computer test results can be manipulated by choosing 'n' suitable."

Classifieds

Rates for advertising in this section: $1 per word. Minimum: 15 words. Allow two months for appearance (usual publication lag). Announcement of human tournaments that are open to computers published without charge. Send all submissions for this section to COMPUTER CHESS CLASSIFIED DEPARTMENT

NEW PROGRAM FOR SALE:

New computer chess program, "MYCHESS," runs under the Cromemco Z-2 system (CDOS or CP/M). It is written in Z-80 with less than 20K memory and large opening book. Does a full-width two ply search in 5 seconds (4 MHz clock). Price $20 which includes a copy of the source code and the object code on either an 8" or 5" floppy. Write to David Kittinger, 2431 Lyvona Lane, Anchorage, AK 99502.

MICROCHESS "COMPARISONS:"

Microcomputer chess being played against rated players and other programs for comparison purposes. Interested in getting your program or device into these unbiased tests? Contact John Urwin, 1537 Argyle Court, San Jose, CA 95132.

PLAY EUCHRE:

The card game of Euchre originated among the Pennsylvania Dutch prior to 1864 and is still popular in many areas of the country. You can play this interesting game on a cassette for the PET for $10. Listings available for $8.50 for conversions to other machines. Mike Pershing, 873 N.Monroe Dr., Xenia, OH 45385.

BACKGAMMON FOR TRS-80:

Micro-backgammon 1.5 for TRS-80. Three levels of play. Animated graphics plus literal display. One cassette with two versions (Levels I and II) for 4K machines. $19.95 Questar Software, PO Box 723, Wichita, KS 67201.

BACKGAMMON CHALLENGE:

Challenging "GIGA" Backgammon for North Star BASIC with options available for $15.00 per disk. John Shepard, 2204 Central Street, Evanston, IL 60201.

COMPUTERS WELCOME:

All Montreal Chess League tournaments are open to computers. Schedule of events to the end of 1979: Fall Open (Nov. 10-11); One Day Event (Nov. 24); One Day Event (Dec. 8); Santa Claus Open (Dec. 26-31). For complete details contact Montreal Chess League; 445 St. Francois-Xavier; Montreal, Canada; HZY ZT1 Tel. (514) 845-8352.

BACKGAMMON CASSETTE:

The GAMMON CHALLENGER gives all backgammon players a battle. Has 3 levels of play. Switches sides, tests problems and stores positions in memory. Available on TRS-80 cassette for either Level 1 or Level 2. $14.95 each. Computer Cablevision, 2617 42nd Street, NW, Washington, DC 20007.

Inside Chess Challenger

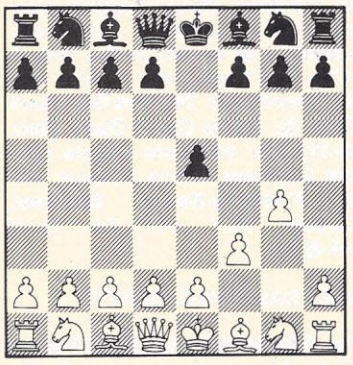
(John Larkins is editor of CHESS VOICE in Oakland, CA as well as serving as chess columnist for the BERKELEY GAZETTE. His interesting peek into a microcomputer chess device appeared in one of last summer's editions of CHESS VOICE. Because of the excellent analysis it is reprinted here with the author's permission.)

"Your choice of three levels of difficulty — approximately 1200, 1400, 1650, as rated by the United States Chess Federation." "The microcomputer's high level thinking ability enables it to respond just like a skilled human opponent." "The third level is at about 1700, and this approaches the ratings of a Master Chess Player."

These are quotes from various advertisements for Chess Challenger, a chess-playing micro-computer. In less than a year, 30,000 of these have been sold at prices ranging from $240 to $280.

If all this sounds too good to be true, it is — according to local chess buffs who have experimented with it. (Prominent among these are Richard Shorman, Jim Hurt, and Lance Gilmore.)

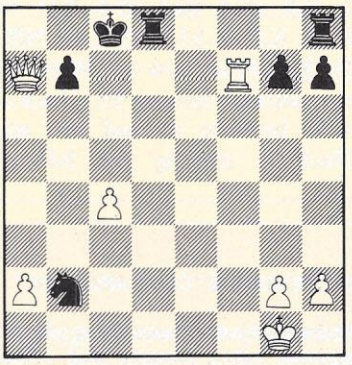
Is it true, as the ads claim, that Chess Challenger "actually PLAYS CHESS!!"? Since the microcomputer makes better moves than most beginners, the obvious answer is, "Of course it does." But the matter is not so simple. Although it can produce short sequences of irreproachable moves, it is also totally blind to the overriding importance of the ever-vulnerable king — the very thing that makes chess the uniqe game that it is.



Fool's Mate

In the well known Fool's Mate, 1 P-KN4, P-K4 2 P-KB3, the Challenger refuses to make the mating move 2 . . . Q-R5 mate. (See the "Fool's Mate diagram). Why? Although the computer recognizes when it has been checkmated, it does not recognize when it has carried out a checkmate, and will play on, if allowed to continue. And playing on would lead to: 3 P-QR3 (or any other move). Q×K (?) Q×Q! — with the machine losing its very valuable queen for a considerably less valuable king.

The micro-computer decides what to attack or defend in terms of a point system. It acts as if a pawn is worth 1 point, a knight 3, and a bishop 3-1/2.

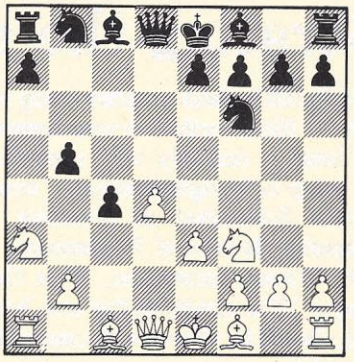


Double Threat

But the king is worth only 2! Thus, if it must choose between capturing a king or a knight, it will go for the more valuable knight every time. After all, a mate is just another capture as far as the machine is concerned.

On defense, in a situation where its opponent presents two threats (see the "Double Threat" diagram (1) QxP mate and (2) RxNP — the machine will always protect the pawn. Why? To lose the pawn is to lose a point, but if 1 QxP check, Challenger is prepared to play 1 . . . KxQ (!) and, even after 2 RxK, it still has a net gain in material — since a queen is worth 9 points and a king plus a pawn total only 3 points.

This sequence will not actually occur on the board because, as soon as the human player plays QxP, the machine's special mate-recognizing circuit will be triggered and its "I LOSE" light will turn on. But it does occur in the computer's internal decision-making process, at which time it hasn't the slightest inkling that it is being threatened with a mate in one.



Royal Fork

Once we understand this basic flaw, we also understand why the machine has an "I LOSE" light but no "I WIN" light and why the machine is described as "not programmed to win." Since the Challenger is totally material-minded, it can only win by getting so far ahead in material that its discouraged human opponent throws in the towel. The only two exceptions are: (1) an accidental mate, or (2) a late-stage endgame where the king becomes a target for capture because it is the only piece more valuable than a pawn left on the board.

If the machine is attacked twice, it will defend twice. But if it is attacked three times, it will wander off to make an irrelevant move in some other part of the board. And if it faces a double attack, a discovery, or the threat of mate, it gets quite bewildered and can no longer see even two moves ahead.

In the "Royal Fork" diagram, Chess Challenger (playing Black) saw the threat NxNP and defended with 7. . .P-QR3 — blind to the fact that after 8 NxP, 8. . . PxN? only leads to 9 RxR! When White grabbed the pawn (8 NxP), the machine finally saw the pin and did not retake. Instead, it defended its now-defenseless QBP with 8 . . .B-K3?

Whereupon White threw in the bombshell 9 Q-R4! — threatening double-check and mate. Challenger accidentally avoided the mate with 9 . . .Q-B1 (giving the king an escape square) — but this move was almost surely chosen only to give an extra de-

fender to the doubly-attacked QBP. Of course, White finished up with the devastating 10 N-Q6 double check — a royal fork that wins the computer's queen.

Wiping out the machine in such a decisive fashion can be a distinct pleasure the first few times. But once it dawns on the human player that the machine doesn't even see (much less care about) his brilliant attacks, and that it will blindly fall into the same trap again, the fun rapidly drains away.

Despite these flaws, the Challenger has been suggested as a useful device for novices interested in learning chess fundamentals. Yet any novice serious enough about the game to shell out $280 for such a learning device would progress much more rapidly (at one-tenth the cost) by buying two or three chess books and studying them.

Admittedly, the chess-playing machine is more fun. But, in the end, Chess Challenger is not very challenging. Even children (who love it, at first) will eventually stumble onto its blind spots — turning it into a sitting duck.

(Since the appearance of John's preceding analysis, the world of microcomputer chess has moved forward. Just as a novice chess player becomes a better player with time, so to have most of the current chess programs and chess devices. In fact, the Chaftiz company maintains that its new "Sargon/Boris" machine will demonstrate that it has a chess rating possibly higher than even John Larkin's. It would be educational for us side-line buffs to see John take on one of the new devices and evaluate its improved playing abilities.)

The Knight Watch

Putting the Knight on display so that he can be *watched* as he makes his famous tour around the board is Bob Doidge's contribution to the popular program. "Since the beginning of this year, when the high school where I teach" — Bob lives at 2401 So. Hacienda Blvd., Hacienda Heights, CA — "bought a TRS-80 Level II, I have been having fun learning programming, adapting the programs in *PERSONAL COMPUTING* and creating my own. (Among others I have a horserace program written from scratch which accepts win, place or show bets and then races the horses across the screen, and a program which plays "Passout" written when I had the computer home one weekend.) Unfortunately we do not as yet have a printer so I have not been able to submit the program.

"However, Chet Dyche's Knight's Tour program (Sept. '79) requires only a few more lines for a vast improvement in its appearance on the TRS-80. By making the following additions and changes, a chess board will appear on the screen and a Knight will trace his tour over the board:

```
90  CLS: CLEAR 1000
156 DATA
      151,168,131,188,163,156,147,
      172,131,188,171,148,26,26,24,
      24,24,24,24,24,24,24,24,24,24,
      24,181,138,176,143,184,135,
      189,130,176,143,186,133
172 A$=STRING$(6,191):B$=A$+
      CHR$(26)+STRING$(6,24)
      +A$
174 FOR I=1 TO 19: READ A,B:
      KN$=KN$+CHR$(A):
      KP$=KP$+CHR$(B): NEXT
260 INPUT R1, C1:RP=R1:CP=C1
280 J=R1:K=C1:CLS
282 FOR M=1 TO 8: FOR N=2 TO 9
      STEP 2
283 IF INT(M/2)=M/2 THEN Q=0
      ELSE Q=1
284 PRINT@(M-1)*128+(N-
      Q)*6,B$;
286 NEXT: NEXT
288 PRINT@(J-1)*128+K*6,KN$;
662 PRINT@(RP-
      1)*128+CP*6,KP$;
664 same as 288
666 RP=J:CP=K
675 FOR T=1 TO 2000: NEXT: CLS
685 PRINT: PRINT
705 IF C(I,L) 10 THEN K=0 ELSE
      K=1
710 PRINT TAB (L*4—K) C(I,L);
```

ABC's of "Z" Chess

BY GENE BUZA

How many TRS-80 owners play chess? I bet those who do were quite pleased when "Microchess" became available. For many of us, this program soon became tame.

Then came "Sargon", winner of the 1978 West Coast Computer Fair, "Sargon" is good and was only beaten recently by "Chess Challenger 10," a dedicated chess computer from Fidelity Electronics in the Penrod Memorial Tournament.

Now a newcomer has arrived on the scene — "Zchess", from the Software Association, P.O. Box 58365, Houston, Texas 77058. Their ad claims that it is "Possibly the fastest good strategy chess game available! $17.95".

After reading the excellent documentation about "Zchess", I decided to see how well it played. The first thing you notice is that the graphics display, which is sort of a cross between "Sargon" and "Microchess", identifies the playing squares with numbers 1 to 64. This takes a bit of getting used to, but poses no problems. Also, the king and queen are identified by "K" and "Q" over the respective pieces. In addition, in the lower right hand corner of the screen, two numbers are displayed to indicate the current level of difficulty and the present ply that the program is looking thru.

"Zchess" has seven levels of play that range from 10 seconds to (and get this) 30 minutes at a full 6 ply search (that's 6-1/2 moves). The "Software Association" claims "Zchess" uses a unique alpha-beta prune and move sorting routine that brings the response time down to a minimum. In comparison, "Chess Challenger 10" requires 24 hours for a full 6 ply search.

Deciding to put it to the test, I pitted "Zchess" against the "CC-10." In the first game, "Zchess" played white with a 48 second response time against "CC-10" with a 1:20 minute response time. This may seem like the "CC-10" had a distinct advantage with its Z-80A MPU and 4-MHz clock over the TRS—

80's 1.77 MHz clock. But if the claims for "Zchess" were anywhere near true, that shouldn't have made much difference.

The game started with the "CC-10" taking the offensive and for awhile "Zchess" looked clearly outmatched. But by the 28th move, the "CC-10" was ahead positionally and materially (by 2 pawns). But then both programs locked themselves into a repetitive-moves loop that I couldn't break even by upgrading both to two higher levels of difficulty. Thus, the first game was a draw.

Of course, by now my curiosity carried me to demand a rematch. I set both programs to the competition level of 3 minutes per move each with "CC-10" playing white.

The game from the onset saw "CC-10" in the positional lead, controlling the board center and forcing "Zchess" into repetitive moves. At the 24th move, "CC-10" actually had the black king near the center of the board. But then, thru a clever series of maneuvers, "Zchess" manipulated "CC-10" into an exchange that left "Zchess" ahead by a rook and a knight, with good positional advantage. By the 44th move, "Zchess" still had both of its rooks and bishops, a knight, and four. pawns, while "CC-10" had only four pawns. Then, unbelievably, "CC-10" sacrificed three pawns, one by one, to avoid mate. "Zchess", like so many human players, seemed so caught up in its greed that it failed to see the final, concluding, last ditch effort by "CC-10". And there the white king stood, unchecked, and stale-mated. I thought I felt the "TRS-80" keyboard shudder. Final score — two draws.

I think you will be hearing a lot about "Zchess". At times it plays brilliantly and at times it plays, well let's say it plays like a human. My congratulations to its author, Mr. Bill Miller, who also wrote "Dr. Chips" and co-authored "Back-40", two other fine programs. I suggest anyone interested in computer games to give these programs a try. You won't be disappointed.

Gene G. Buza
Bensenville, IL

(Reprinted with permission from Chicatrug News, a TRS-80 Users Group from Chicago; Manny Garcia, Editor. The small newspaper is published monthly by Emmanual Garcia Associates, 3950 N. Lake Shore Drive, Chicago, IL 60613. Annual subscription rates are $12.)

Background on BB-1

The August issue of PC reported a game played between SARGON and BB-1 at the ACM 1978 tournament in Washington. Tony Scherzer, programmer of that "briefcase device" now offers some background facts on his program. (The precursor of BB-1 was prepared as a demonstration program for Singer's System-10.)

"There is no opening book for BB-1," write Tony. "However, the program does look ahead with pruning. Each ply of look ahead is handled differently. Ply 1 evaluate all moves. Ply 2 evaluates all responses. Ply 3 looks at from 15% to 100% of all available moves. The static board evaluation is done at Ply 3. Three looks at all captures and all moves that give check and will continue to look at additional moves if it feels it is in trouble. On the average it will look at 40% of available moves.

"Ply 4 looks at from 3% to 100% (average 100%) of responses. If in check it will look at all legal moves which will get it out of check. It looks at all captures and if the position doesn't lose more material it passes the value back.

"Ply 5 looks only at recaptures, upcaptures and captures of undefended pieces. The recaptures evaluated deal with captures at Ply 4 unless the opponent is in check at Ply 2 or Ply 4 in which case it looks at all captures of undefended pieces.

"Ply 6 also looks at recaptures, upcaptures and captures of undefended pieces.

"Ply 7 is the same as Ply 6 unless material was lost at Ply 2 in which case a search to recapture and achieve equality is made. If this is not possible, evaluation terminates.

"Ply 8 is the same as 7 in reference to Ply 4. Ply 7 and 8 are recursive and continue in this mode.

"The BB-1 program has gone down to 25 plys. We do not yet know why it moves this far. In three minutes the machine will process about 20,000 to 25,000 nodes. The program employs forward pruning from Ply 3 down.

"The hardware of BB-1 is a 4 MHz Z80 microprocessor with 16K RAM memory and a CRT display or small console keyboard. We have ambitious plans for the future. Just as BB-1 was implemented on an expanded telecommunications adapter, our new chess program will run on an enhanced DSU (our new Disk Staging Unit.) The DSU is based on AMD bit slice architecture with a 222 ms cycle time for a 64 bit instruction. Memory is 50 to 800 K. The enhanced version for chess will use a 100 ns cycle time with an 80 to 96 bit instruction size. Special hardware is being designed for move generation, move making/restoring and board evaluation. Most of this special hardware is designed to work at 50 ns clock rates. The final goal is a machine that can handle 10,00 modes per second.

"The availability of the Z80-based microprocesser contained in the BB-1 raised the question of producing a chess playing program that would run 'stand alone.' A program, then, was written for BB-1 with the new concept. This computer was significantly faster than the Singer at chess and no memory limit existed. The new program was able to easily beat System-10 chess. In fact, the play was so far superior to the old program that no one at System-10 was able to consistently beat BB-1. It was decided to enter BB-1 in the North American Tournament in Washington in December of 1978. Unfortunately for BB-1 there were too many other entries so BB-1 was made an alternate and had to sit on the sidelines. We did manage to get in a few unofficial games with some of the other programs."

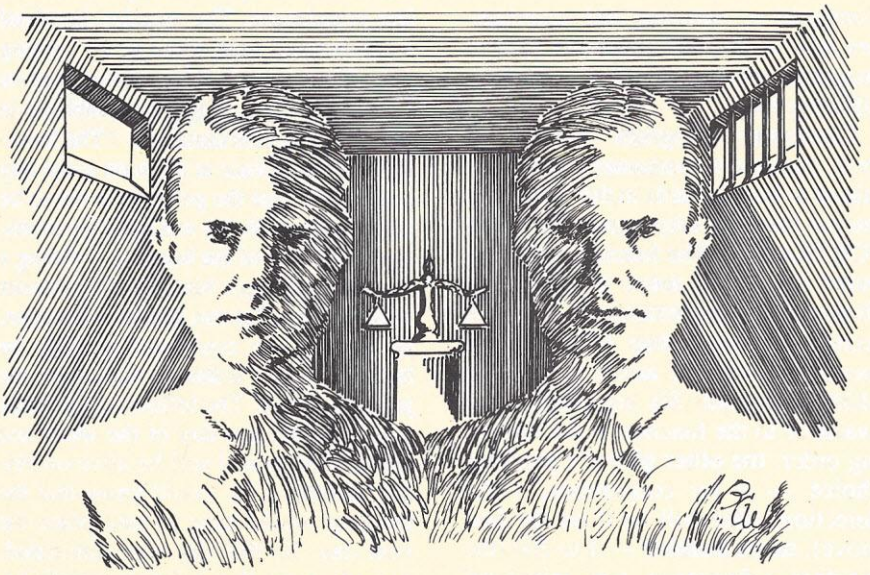
("Intelligent" Computer games welcomed by this department. Address all correspondence to COMPUTER GAMES DEPARTMENT, Personal Computing.)

Prisoner's Dilemma

A "game" of PRISONER's DILEMMA was recently played in the form of a tournament conducted by Professor Robert Axelrod of Michigan University's Institute of Public Policy Studies.

Basically, the scenario of PRISONER's DILEMMA involves two prisoners who have been arrested by the police and who are being interrogated by the district attorney. The DA is certain that the two suspects are guilty of a specific crime but he does not have sufficient evidence to bring them to trial. Therefore, he tries to get them to "confess". He tells each of them that he (the suspect) has two alternatives: to confess to the crime the police are sure he has committed; or not to confess. Now, if they both **refuse** to confess, the DA says he will then book them on a minor charge and they will both get a minor punishment. If they both **agree** to confess, he says, they will be prosecuted but he will then recommend a lighter sentence. However, if one of them confesses while the other does not, then the confessor will get a light sentence for turning state's evidence and the non-confessor will get the maximum. In court, the two will get the punishment they deserve. In converting this to a "game," plus or minus points are given for the responses. If both defect (refuse to confess) in the game they both get -1 point. If they both confess, they both get 5 points. If one confesses and the other defects, the confessor gets -5 points and the defector gets 10 points. The "game" was played in the Axelrod tournament as a series of 200 moves and the program with the highest score was declared the winner.

A player is told **after** each move, how his opponent had "played." The dilemma begins from that point. How shall a player "vote" knowing what his opponent has done on the previous move, or the first 10 moves, or the first 50? Is there a pattern in the opponent's choice? Can he be outwitted? Can the opponent's decision be anticipated?



Can the opponents be trusted to vote as expected? These questions then become the basis for the game and determine the complexity which arises from the apparently simple-looking box scores. Of four possible "moves":

	Points Earned		Points Earned
Player A Confesses	5	Player A Confesses	−5
Player B Confesses	5	Player B Defects	10
Player A Defects	10	Player A Defects	−1
Player B Confesses	−5	Player B Defects	−1

Skill in playing the game successfully depends on proper use of what is known of the other player based on the history of his performance. This sounds simple, says Professor Axelrod. However, the number of possible iterated PRISONER's DILEMMAs of 200 moves each is the astronomical figure 10^{120} (same number of possible chess games).

Writing a computer program for PRISONER's DILEMMA is a fairly simple matter. Each program is based on one of the six decision rules that were designed for the Axelrod tournament. Each rule represents a different way for the computer to use the information (make a decision) based on iterations of the PRISONER's DILEMMAs.

The first "rule" in the tournament, "TIT FOR TAT," was a simple one. In this rule, the program notes an opponent's preceding choice, then makes the same decision for its own choice. On the very first move of a game, when there is no previous information about the other player, the program cooperates by confessing. The six rules used in Prof. Axelrod's first tournament were:

1. **Cooperate all the time** ("TIT FOR TAT")
2. **Defect all the time** ("RANDOM")
3. **Use player's previous two moves to predict his next move, then make the same move.** ("MODAL")
4. **Identify a repeating series and repeat the next move made by the opponent following the series.** ("ANALOGY")
5. **Use most recent performance to make a prediction of next re-**

sponse. ("LOOK AHEAD")

6. **Establish a probability factor for cooperation. After each move change the probability factor according to a formula. Then make a choice based on this revised probability.** ("LINLEARN")

Competition, variation and uncertainties arise in the tournament as various programs meet each other with their differing rules.

Computer program entries to Prof. Axelrod's tournament were submitted to him on cards in the form of an integer function subprogram written in FORTRAN IV. The function was computed once each move to produce a choice: 0 for cooperation or 1 for defection. No more than 2000 memory locations could be saved in DIMENSION statements. Six arguments were available to the function in the following order: **the other player's previous choice** — 0 for cooperation, 1 for defection, (this will be 0 on the first move); **move number** — 1 to 200 (the function subprogram was initialized each time move 1 was encountered. This prevented the program from accumulating experience across games within the tournament); **your score** — 0 to 1000; **other's score** — 0 to 1000; **proportion of time remaining to you** — 0. to 1. inclusive, (the time limit was sufficient for some calculations on every move, but complex calculations had to be done only on selected moves. When the time available fell below zero, the game was concluded on the assumption that the program cooperated on each move while the other player defected); **and a new random number** — 0. to 1. inclusive. The first four arguments were integers and the last two floating points. Following is an example of a computer entry named NICE which defected only when the other player had defected on the previous two moves;

```
FUNCTION NICE (JPICK, MOVEN,
ISCORE, JSCORE,TIME, RANDOM)
IF (MOVEN.EQ 1)JOLD=0
NICE=0
IF ((JOLD.EQ.1) .AND. (JPICK.EQ.1))
NICE=1
JOLD=JPICK
RETURN
END
```

The history of PRISONER's DILEMMA is traceable to other studies in philosophy, psychology, sociology, etc. One familial resemblance is mirrored in the well-known "hangman's paradox" which first appeared during the 1930 depression when hangings and crime were rampant among a disconsolate population. The paradox involved a condemned man about to be "strung up". The victim had been sentenced on a Saturday by a judge who dabbled in puzzles. His proclamation: "The hanging will take place at noon on some day next week. But the prisoner is not to be informed which day it is until the morning of the day of the hanging." Being a man of some logic himself, the prisoner was overjoyed at this sentence because, he figured, he could not possibly be hanged now without violating the judge's decree. The following Saturday would be the last day of the week and because he would still be alive on Friday afternoon he would know that the hanging would have to take place the next day. So that day was eliminated, according to the judges's condition. With Saturday ruled out, that brought up Friday. But that day, too, was ruled out because being alive on Thursday afternoon the prisoner knew he could not be hanged on Friday because he would know about it beforehand. In a similar manner he calculated that every day of the week fell into the "last day syndrome" and he would thus go scot free — thanks to a dumb judge. But on Thursday morning the hangman arrived unexpectedly, of course, and informed him that he was about to be hanged. So, the judge was correct, after all, because the prisoner **didn't expect** to see the hangman on Thursday — nor on any other day of the week! Result: One dead prisoner!

Another similarity exists between PRISONER's DILEMMA and "Morra" (an Italian numbers game with origins buried in ancient history.) In this game of pure logic, two players each "throw out" any number of fingers from one hand and call out any number from **one** to **ten.** Whoever calls the correct combination of fingers of the two hands wins a point. A game is won after a predetermined number of points is reached. An illustration of the complicated logic involved in this apparently simple game: Player A throws out **two** fingers and calls **five**! Player B throws **four** fingers and calls **seven**! Now each player observes how many fingers his opponent has thrown and what number has been called. Player A, for instance, decides that Player B's favorite call number is **seven.** So, he vows always to throw **one** finger to thwart his adversary. Can't make **seven** with a **one**! At the same time, he notes that B has thrown **four** fingers. Very well! He will trust B to throw **four** fingers again and will continue to throw **two** fingers and call **six**! If B is to be trusted he will foolishly throw out **four** fingers again and lose a point. However, B has noticed that A keeps throwing **two** fingers and calling **six**! So, avoiding a **four**-finger throw, B throws **one** finger and calls **three** hoping to snatch a point. But A is not cooperating. He notices that B has changed his sequence so now, he throws **no** fingers at all to get a new line on B's strategy. Morra, then, is related to PRISONNER's DILEMMA. One must be able to figure out quickly the opponent's pattern in order to compete successfully

"The distinguishing feature of Prisoner's dilemma" writes Prof. Axelrod, "is that in the short run neither side can benefit itself with a selfish choice enough to make up for the harm done to it from a selfish choice by the other. Thus , if both cooperate, both do fairly well. But if one defects while the other cooperates, the defecting side gets its highest payoff, and the cooperating player is the **sucker** and gets its lowest payoff! This gives both sides an incentive to defect. The catch is that if both do defect, both do poorly. Therefore, Prisoner's Dilemma embodies the tension between individual rationality (reflected in the incentive of both sides to be selfish) and group rationality (reflected in the higher payoff to both sides for mutual cooperation over mutual defection). The payoff structure of each move in a typical Prisoner's Dilemma is shown below:

		Column Player	
		Cooperate	Defect
Row Player	Cooperate	3,3	0,5
	Defect	5,0	1,1

TOURNAMENT SCORES

Players \ Other Players	TIT FOR TAT	TIDEMAN AND CHIERUZZI	NYDEGGER	GROFMAN	SHUBIK	STEIN AND RAPOPORT	FRIEDMAN	DAVIS	GRAASKAMP	DOWNING	FELD	JOSS	TULLOCK	WINER	RANDOM	Average Score
1. TIT FOR TAT	600	595	600	600	600	595	600	600	597	597	280	225	279	359	441	504
2. TIDEMAN AND CHIERUZZI	600	596	600	601	600	596	600	600	310	601	271	213	291	455	573	500
3. NYDEGGER	600	595	600	600	600	595	600	600	433	158	354	374	347	368	464	486
4. GROFMAN	600	595	600	600	600	594	600	600	376	309	280	236	305	426	507	482
5. SHUBIK	600	595	600	600	600	595	600	600	348	271	274	272	265	448	543	481
6. STEIN AND RAPOPORT	600	596	600	602	600	596	600	600	319	200	252	249	280	480	592	478
7. FRIEDMAN	600	595	600	600	600	595	600	600	307	207	235	213	263	489	598	473
8. DAVIS	600	595	600	600	600	595	600	600	307	194	238	247	253	450	598	472
9. GRAASKAMP	597	305	462	375	348	314	302	302	588	625	268	238	274	466	548	401
10. DOWNING	597	591	398	289	261	215	202	239	555	202	436	540	243	487	604	391
11. FELD	285	272	426	286	297	255	235	239	274	704	246	236	272	420	467	328
12. JOSS	230	214	409	237	286	254	213	252	244	634	236	224	273	390	469	304
13. TULLOCK	284	287	415	293	318	271	243	229	278	193	271	260	273	416	478	301
14. WINER	362	231	397	273	230	149	133	173	187	133	317	366	345	413	526	282
15. RANDOM	442	142	407	313	219	141	108	137	189	102	360	416	419	300	450	276

PROGRAMS AND PLAYERS

1. "Tit for Tat"
(Anatol Rapoport of the Systems Science Center, University of Louisville.)

2. "Tideman and Chieruzzi"
(Nicolas Tideman and Paula Chieruzzi, Department of Economics, Virginia Polytechnic Institute and State University.)

3. "Nydegger"
(Rudy Nydegger, Department of Psychology, Union College, Schenectady, NY)

4: 4. "Grofman"
(Bernard Grofman, Public Policy Research Organization, University of California, Irvine).

5. "Shubik"
(Martin Shubik, Department of Economics, Yale University).

6. "Stein and Rapoport"
(William Stein, Mathematics Department, Texas Christian University and Amnon Rapoport, Dept. Psychology, U. of North Carolina).

7. "Friedman"
(James W. Friedman, Dept. of Economics, U. of Rochester).

8. "Davis"
(Morton Davis, Dept. Mathematics, City College, CUNY)

9. "Graaskamp"
(James Graaskamp of Beloit College).

10. "Downing"
(Leslie Downing, Dept. of Psychology, Union College, Schenectady, NY.)

11. "Feld"
(Scott Feld, Dept. of Sociology, U. of Calif. Riverside.)

12. "Joss"
(Johann Joss, Eidgenossishe Technische Hochscule, Zurich.)

13. "Tullock"
(Gordon Tullock, Center for Study of Public Choice, Virginia Polytechnic Institute and State University)

14. "Winer"
(Mark Winer, School of Urban and Public Affairs, Carnegie-Mellon.)

15. "Random"
(A test program that randomly cooperates and defects with equal probability and which played against every other program.)

(The payoff to the row player is given first in each pair of numbers.)

"The fact that interactions are repeated is very important to the dynamics of the situation. If the two sides knew that there would be only a single choice there would be every incentive to defect since no matter what the other player chooses, defection yields a higher payoff than cooperation. But actors often have ongoing relationships with both an informative history and an important future. Making effective choices in such an ongoing relationship requires insight into the structural implications of strategic interaction.

"Suppose, for example, that in an interaction between the United States and the Soviet Union both sides are following a strategy of TIT FOR TAT: cooperate initially, and thereafter cooperate if the other side cooperated last time and defect if the other side defected last time. This pair of strategies would lead to an unending stream of mutual cooperation. But now suppose that one side or the other decided to make a minor change in its strategy to seek a slightly greater measure of success. One such change would be to cooperate 90 percent rather than 100 percent of the time after the other side has just cooperated. This change in strategy may seem promising because it occasionally yields the highest possible payoff, while still punishing the other side for any defections it might undertake. In fact, this slight and seemingly advantageous variation on TIT FOR TAT actually performs much worse than the TIT FOR TAT strategy in a variety of settings, and leads to unrewarding mutual defections.

Since behavior in the game reflects so many important factors about people it has become a standard way to explore questions in social psychology from the effects of Westernization in Central Africa to the existence (or nonexistence) of aggression in career-oriented women. In the last ten years there have been over 350 articles on the Prisoner's Dilemma cited in *Psychological Abstracts*. The iterated Prisoner's Dilemma has become the *E. coli. (a common bacteria)* of social psychology.

"To learn techniques on how to choose effectively in an iterated Prisoner's dilemma, a special approach is needed. such an approach would have to draw on people who had a rich understanding of the strategic possibilities. It would also have to take into account two important facts about strategic interaction in a non-zero sum setting. First, what is effective is likely to depend not only upon the characteristics of a particular strategy, but also upon the nature of the other strategies with which it must interact. The second point follows directly from the first. An effective strategy must be able to take into account at any point the history of the interaction as it has developed so far.

"Computer tournaments for the study of effective choice in the iterated

Prisoner's Dilemma meet these needs. In a computer tournament each entrant writes a program which embodies a decision rule to select a cooperative or noncooperative choice on each move. The program has available to it the history of the game so far, and may use this history in making its choice. By recruiting the participants primarily from those who have written on game theory and especially the Prisoner's Dilemma, the entrants are assured that their decision rule will be facing rules of other experts. Such recruitment also guarantees that the state of the art is represented in the tournament.

"Tournaments such as these were completed recently. The results of the first tournament contain some real surprises. These surprises in turn offer new insights into the questions of how to understand and how to cope with an environment which contains aspects of the Prisoner's Dilemma.

"Each game of the tournament consisted of exactly 200 moves with each entry paired with every other entry. Points were awarded as shown in preceding table. No entry was disqualified for exceeding the allotted time. In total there were 120,000 moves, making for 240,000 separate choices. The 14 entries of the first tournament came from three countries and five disciplines. A useful benchmark for very good performance is 600 points which is equivalent to the score attained by a player when both sides always cooperate with each other. A poor performance is considered 200 points where both sides never cooperate with each other. Most scores in the tournament ranged between 200 and 600 points, although scores from 0 to 1000 points are possible. The winner, TIT FOR TAT, averaged 504 points per game. The programs submitted varied in length from only 4 lines long in FORTRAN for the winner, TIT FOR TAT, to a 77 line program, WINER, which finished next to last. Final results of the tournament are shown in accompanying table.

(In a future article in this department, further information on the programs themselves and the logic of this "game" will be discussed. Also, the results of the 2nd tournament by Prof. Axelrod will be listed as well as plans for future tournaments.)

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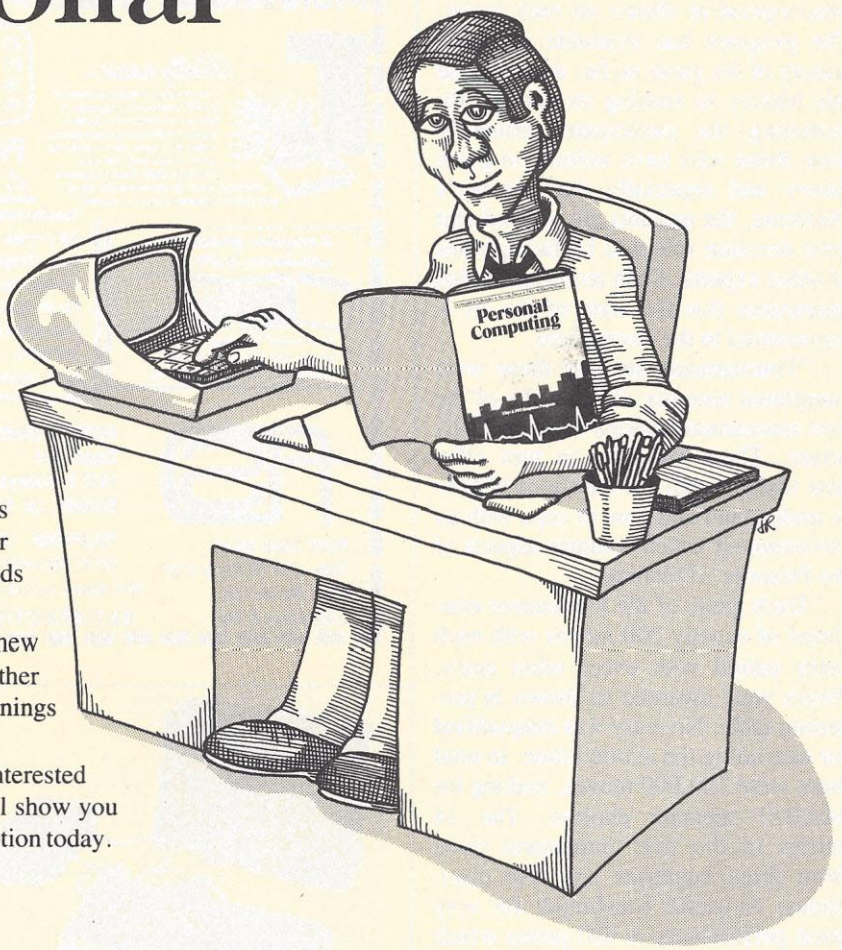

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Arguments on the Logic of Computer Bridge

BY THOMAS A. THROOP

My computer bridge playing program recently produced the following interesting deal;

COMPUTER NORTH (Dummy)
♠ QJ10532
♥ KQ
♦ AQ974
♣ —

WEST	EAST
♠ K9864	♠ A7
♥ J8	♥ 653
♦ J6	♦ K1032
♣ A543	♣ 10982

COMPUTER SOUTH (Declarer)
♠ —
♥ A109742
♦ 85
♣ KQJ76

South was the declarer at a contract of 4 hearts and West opens with the jack of diamonds. The computer program finesses the diamond queen from North, losing to East's king. East makes a safe return of the 3 of hearts, the computer winning with dummy's king.

The program now recognizes the existence of a ruffing finesse in clubs if West holds the ace and one trump is retained in dummy. Accordingly, a low spade is led from North and ruffed with declarer's 4 of hearts. Now in the South hand for the ruffing finesse, the program leads South's king of clubs, intending to discard from the dummy if West plays low. West elects to duck and the program discards the 3 of spades from dummy. The program continues with the queen of clubs from South, repeating the ruffing finesse. This time West covers with the ace of clubs, which is trumped by North's queen of hearts.

At trick 6 the computer program enters declarer's hand by leading a low spade from dummy and ruffing with the 7 of hearts. Next comes the ace of trumps from South, which fortuitously drops the enemy jack. The program discards the 4 of diamonds from dummy. The 10 of hearts is then led from declarer's hand to draw the last oustanding trump.

The program now returns to the club suit, cashes the jack of clubs and then leads the 7 of clubs, losing to the 10, but establishing the 6 as a winner. The computer program wins the last three tricks with North's ace of diamonds, and South's 10 of hearts and good 6 of clubs. Thus, with good play on its part, the computer program makes 5 hearts on this hand!

The complete play of the deal is shown in the accompanying tableau.

Stephen White of Westport, Connecticut 06880 has sent us some comments. "What is on display in the June issue is not in any sense bridge," he complains. "The algorithms built into the program seem to be so primitive as to be useless; one might as well direct the computer to follow suit and otherwise play at random."

In response, I must first point out that the product of George Duisman is designed to allow a bridge enthusiast to practice his own play of cards as declarer. In meeting this objective, I think George has developed a good initial product. I wonder if Stephen has achieved the maximum results in the deal previously discussed in this column. If not, then I suggest that more practice against the Duisman program would be worthwhile.

Secondly, the Duisman program is obviously not designed to be a great effort in artificial intelligence. Rather, it is a bridge product for the home consumer (as just explained). Thirdly, the defensive algorithms, while perhaps not brilliant, are certainly not so primitive as to be useless. The defensive algorithms will not make many silly mistakes and certainly play far better than simply choosing a random card. It would be instructive to know which deals Stephen refers to in his comments.

White's letter continues: "Some time ago I attempted a limited task on the TRS-80. I programmed it to generate North and South hands in which the South hand met various criteria for an opening bid of 1NT. This was the simplest bidding task I could devise. I was unable to complete the task I had set for myself because I ran out of 16K in no time, leading me to believe that an adequate bidding program covering all situations would require many millions of

	West	*Computer North (Dummy)*	*East*	*Computer South (Declarer)*
Trick 1	*JD*	*QD*	*KD*	*5D*
2	*8H*	*KH*	*3H*	*2H*
3	*4S*	*2S*	*7S*	*4H*
4	*3C*	*3S*	*2C*	*KC!*
5	*AC*	*QH*	*8C*	*QC*
6	*6S*	*5S*	*AS*	*7H*
7	*JH*	*4D*	*5H*	*AH*
8	*8S*	*7D*	*6H*	*10H*
9	*4C*	*10S*	*9C*	*JC*
10	*5C*	*9D*	*10C*	*7C*
11	*6D*	*AD*	*2D*	*8D*
12	*9S*	*JS*	*3D*	*10H*
13	*KS*	*QS*	*10D*	*6C*

Tricks N-S (computer): 11
Tricks E-W: 2

bits. That would still leave uncovered the play of the hand, and would ignore tactical considerations beyond the level of the single deal; it would not cover deception on the part of the opponents; it would not allow for the fact that opponents may be playing any one of a dozen different systems. I am curious to know how this compares with the complexity of programming chess."

Regarding these thoughts, I have several comments. First, a routine to deal the cards and see if a given hand meets the requirements for an opening bid of 1NT can easily be written in about twenty Fortran statements requiring a few hundred memory locations. The entire bidding program of the Fidelity Electronics"Bridge Challenger" takes only about 10K of memory. I discussed this program in the July column. Stephen's programming approach was, apparently, much too inefficient. Secondly, regarding the play of the hand, Fidelity's playing program for the same product, while not playing at a very high level, consumes only about 6K of memory.

Stephen raises the questions of different systems (applicable to the development of a bidding program) and of deception (applicable to the development of both a bidding and a playing program). An initial bidding program, such as Fidelity's, must certainly restrict itself to one bidding structure. Different point requirements may be appplied to a particular bid to allow for consideration of more than one system. In the case of the Fidelity product, the consumer may ask the computer to apply either the "Standard American" or European "Acol" requirements to several of the bids. For a bridge bidding or playing program to consider deception is indeed a very difficult task, to be addressed only after a program can bid or play at a very high level without considering deception.

Stephen questions the complexity of programming bridge versus the complexity of programming chess. In both the August column and the October column I listed a number of reasons arguing that the programming of bridge is much more difficult than the programming of chess. The key point is that chess programs written to date simply play chess by brute force; that is, by generating as many positions for as many moves ahead as time and/or the computer memory will allow and then scoring each position. On the other hand, my bridge playing program and that of Fidelity's, for instance, rely on the application of heuristic techniques, (a far more difficult approach). I think the fact that there are fewer computer bridge programs than computer chess programs also answers this question succcinctly.

Stephen concludes: "It is, of course, child's play to write programs that will deal the cards, applying any constraints with respect to strength and distribution and even the location of specific cards that one may wish to apply. I have found this very useful, in an entertaining sort of way. Having been informed of an interesting convention designed to deal with opening bids of 2NT, I was able to study literally thousands of hands of the requisite type, and now have a theoretical understanding of such hands that I couldn't have developed any other way. There is, of course, some question of how much such theoretical understanding is worth at the bridge table, but I suppose it can't hurt. (It may have lost me an important championship match.)"

Here Stephen seems to have reversed himself on the difficulty of writing a computer program to deal the cards and see if any given hand qualifies for an opening bid of, say, 1NT or 2NT. I am puzzled as to why the implementation of recognizing a 1NT bid was virtually impossible while recognizing a 2NT bid was no problem at all.

As mentioned in the September column, the use of a computer program in selectively generating bridge hands to meet specified criteria is a significant tool in developing and perfecting a successful bidding system. This technique has been used by the "Dallas Aces", perhaps the most successful U.S. bridge team in the last decade. I would be interested in learning what presumably theoretically correct play cost Stephen his championship match. Certainly in any given hand a theoretically correct play may fail where a theoretically inferior play may succeed. In the long run, however, the players who make the most theoretically correct plays will win the most championships.

A second letter has come from Dr. Ronald G. Ragsdale, an associate professor at the Ontario Institute for Studies in Education in Ontario, Canada. He writes "Your paper on 'Computer Bridge' in the *NCC '79 Personal Computing Proceedings* has come to my attention. Several years ago I began to write a bidding program with the intention of creating a system that would allow the user to play from zero to four hands at a randomly created deal. No changes have been made to this program since December of 1975 and most of the work was done in 1974. The program is written in a version of BASIC and achieved limited success in handling an exchange of four bids (bid-response-rebid-response) before my interest waned." Professor Ragsdale has a strong interest in the present status of bridge playing programs. I have invited him to become a regular reader and/or contributor of information in this column. His comments and opinions should prove very valuable to programmers of computer bridge.

We are still soliciting replies from our readers to last month's bridge "survey". Some of those questions were:

What is the most important event or tournament in which you have ever participated? Where and when? How did you finish?

In your opinion who are the best bridge players in the world?

Do you regularly read a bridge column in some publication? Whose?

Who is your favorite bridge-book author?

Do you know anyone who has written a computer bridge program?

If we were to conduct a computer-bridge tournament sometime in the next 12 months, would you consider entering your program?

Do you own a PET, Apple, TRS-80 or some other microcomputer?

Do you have a copy of the Duisman program? How many hands have you played and which have you found the most interesting?

Comments on any facets of computer bridge are welcome. Please address all correspondence to COMPUTER BRIDGE COLUMN, care of PERSONAL COMPUTING.

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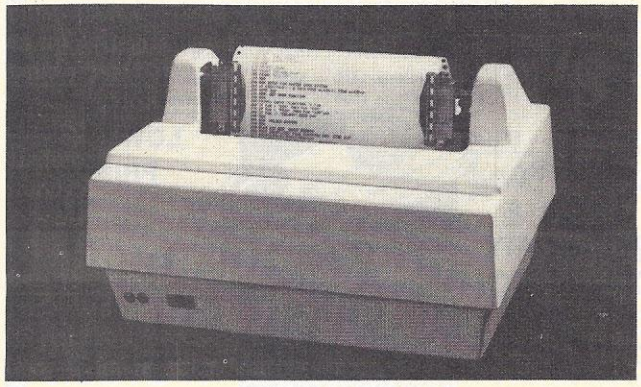
CIRCLE 41

WHAT'S COMING UP

PERIPHERALS

Low-Cost Impact Matrix Printer

Impact Data Inc. has announced its new Model 801 low-cost impact matrix printer for use with microcomputer systems such as TRS-80, Apple II and Compucolor.



Model 801 mechanical features include: a high quality stepper motor driven integral tractor mechanism providing precision incremental paper motion; with both forms width and thickness adjustments; a continuous loop ribbon with re-inking roller for 3 to 5 million character ribbon life; and only 2 moving parts to drive the print head and drive motors that run only while printing.

The unit prints at 132 cps up to 80 columns wide on standard computer forms up to 9-7/8" wide. Up to 5 copies can be printed by the impact head. The standard character set consists of 96 ASCII characters with both upper and lower case.

The printer connects to any computer system via either an RS232 Serial interface or a Centronics-compatable parallel interface, said the company.

Price, which includes electronics, power supply and case, is under $1000 in unit quantities.

For further information contact the printer's distributor, Vitek, 1160 Barbara Drive, Vista, CA 92083; (714) 724-0210. *Circle No. 101*

Apple Speech System

SuperTalker, a new Mountain Hardware peripheral system, allows the Apple II computer to output high quality human speech through a loudspeaker under program control. Output may also be directed through any P.A or stereo system.

Initially, spoken words are digitized into RAM memory through the system microphone. Speech data in RAM may then be manipulated like any other stored data.

The system consists of the peripheral card, which plugs into a peripheral slot on the Apple II; a microphone; a loudspeaker; easy-to-use operating software and documentation; plus two ready-to-run SuperTalker programs.

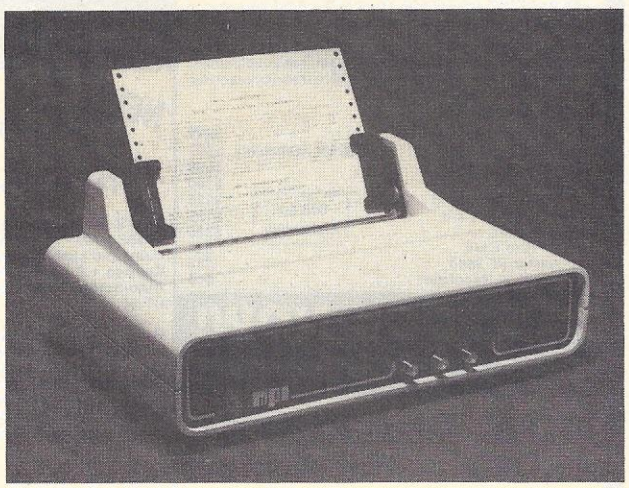
For maximum utility, the SuperTalker Disk Operating System permits output of human speech under program control with I/O routines. It also provides a preparation program which permits the creation of voice files on diskette. BASIC program routines are provided which require only one-line statements to output a word or phrase.

Price is $279 assembled and tested. For more information contact Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060; (408) 429-8600. *Circle No. 102*

Dot Matrix Impact Printer

MPI has announced the Model 88T dot matrix impact printer, the first in a series of new full-capability low-cost printers designed for the general use computing market. The Model 88T features 100 character-per-second bi-directional printing and print line formats of 80, 96 or 132 columns. A full upper and lower case 96 character ASCII set is printed in a 7 × 7 matrix for clear printing on the orginal plus two copies, said MPI. Double wide characters are software selectable and can be intermixed on any line for message highlighting.

Forms handling is implemented with a stepper-motor driven tractor paper feed system that can be adjusted to accept fan-fold forms varying from one to 9.5 inches in width. Eight selectable form lengths and a skip-over-



perforation feature provide for the precise paper handling required when using preprinted continuous forms, said the company. A flick of a lever converts the unit to a pressure roll when using low cost 8.5-inch roll paper up to five inches in diameter. The combination of the forms handling capability and the 10, 12 or 16.5 character-per-inch print density selection allows the user to print on standard multiple copy forms typically used in demand document applications. Each unit has a built-in tear bar for paper tear-off within 0.5 inch of the last printed line.

A long-life, continuous-loop ribbon cartridge eliminates messy ribbon changing. The entire 0.5-inch width of the ribbon can be used even though the character height is only 0.1 inch.

The microprocessor-controlled interface accepts either serial RS232/CL or parallel data. A two-line buffer is stan-

dard, with 1K and 2K data buffers available as options to allow CRT screen dumps.

The casework measures 16.25 inches wide by 10.75 inches deep by 6.25 inches high and is molded from impact resistant flame-retardant plastic. Fan fold forms may be fed from the rear, bottom or front. A detachable paper roll holder is included.

Suggested list price is $749, complete with dual tractor/pressure roll paper feed system and a Serial/Parallel interface. For more information contact MPI, 2099 West 2200 South, Salt Lake City, UT 84119; (801) 973-6053.
Circle No. 145

Automatic Phone Dialer

Softouch, an automatic telephone dialer and disk file directory from scientific MicroPrograms maintains an Apple disk file directory of numbers, ready to dial at your command. You can look up phone numbers by name and have the number dialed without error, said the company. The file contains name, address, phone number and space for personal remarks.

If you aren't sure of the name, or have multiple entries for one name, Softouch will search the file by last name or last name and first name, and list all the possibilities for your selection. It will also display any portion of the alphabetically-organized directory on the screen and let you scroll forwards or backwards. Softouch will search by city or by user-entered remark (for example, name of an organization).

When you've found the name you want, type a single key, touch the telephone mouthpiece to the Softouch Tone Module and the complete number will be converted to standard touch-tone signals.

Entries consist of separate fields for last name, first name, street address, city, state, Zip, phone number and remarks. Each field is 15 characters long, except for the 30 character street address. Since full documentation is provided, the user may add other searching criteria.

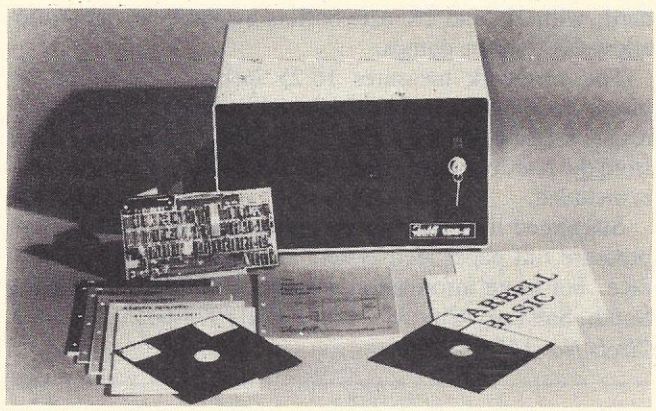
Softouch can even be used with rotary-dial phones, provided your phone company has made touch-tone available. Since no electrical connections are made to the phone lines, there are no FCC or telephone company regulations to worry about, said the company.

A complete Softouch package includes tone module interface card, floppy disk with programs and full documentation. Price is $89 from local computer stores or Scientific MicroPrograms.

For more information contact Scientific MicroPrograms, 1196 East Cunningham Dr., Palatine IL 60067.
Circle No. 146

Dual Disk Drive System

Tarbell's VDS-II Vertical Disk Subsystem includes two Siemens 8" Disk Drives, Tarbell Floppy Disk Interface, CP/M Operating System and Tarbel BASIC. The VDS-II, sold completely assembled and factory tested, is packaged in



a cabinet, with fan and power supply, all cables and connectors, and complete hardware and software documentation.

A Shugart-compatible, single-density, single-sided dual drive system, the VDS-II uses standard IBM-compatible soft sectored 8" diskettes. Capacity per drive is 256K bytes, with a 250 KHz transfer rate. Tarbell's Floppy Disk Interface plugs into any S-100 bus computer. The 32-byte ROM bootstrap program, automatically implemented using Reset, switches off when the bootstrap is completed. Four extra IC slots on the board provide additional flexibility, and on-board circuitry permits the addition of up to four disk drives.

CP/M, from Digital Research, includes such capabilities as Batch Processing, Text Editor, Assembler, Debugger, Compiler, copy capabilities and peripheral interchange. Tarbel BASIC, included in the package, runs on 8080, 8085 or Z80 CPUs.

Price for the VDS-II is $1888. All components are also available individually. For more information contact Tarbell Electronics, 950 Doulen Place, Suite B, Carson, CA 90746; (213) 538-9251; 538-2254. *Circle No. 147*

New Three-Mode Printer

A new printer from Malibu operates in three modes: as a high-speed dot matrix printer at 165 characters per second; a reduced speed, letter-quality dot matrix printer at 90 cps; or a full-graphics matrix printer.

Applications for the Model 165 include computer portraits, custom character sets (Japanese, Katakana, music symbols and so forth) and high-density characters for word processing. Complete dot control is provided for 60 × 72 dots/inch, said the company.

Interfaces include a card for Apple computers, a serial RS-232/ASCII parallel controller card and an S-100 bus I/O card.

Features of the 165 include underlining, expanded characters, programmable horizontal and vertical tabs, selectable left margin, user-adjustable platen (up to 6-part forms) and a time-delay feature which shuts off the fan when the printer is idle to reduce noise and power consumption.

Price is $2395; delivery is 30 days ARO. For more information contact Malibu Design Group, Inc., 8900 Eton Ave., Suite G, Canoga Park, CA 91304; (213) 998-7694.

Circle No. 148

SOFTWARE

TRS-80 Tax Programs

Tax programs provided by Contract Services Associates for the TRS-80 are useful for both professionals and individuals in tax preparation.

The professional version for a 32K system with disk and line printer incorporates many improvements over the firm's 1978 system, said the company.

Programs available for 4K Level I systems and up automatically compute the Federal Income Tax Forms line by line and display the results on the video monitor. Use your computer for income Averaging, Schedule C, Business Income or short-form 1040A.

For more information contact Contract Services Associates, 706 South Euclid, Anaheim, CA 92802; (714) 635-4055. *Circle No. 149*

Alpha Micro Utility Package

Real Oregon Computer Company offers the Alpha Programmer's Utilities Package consisting of 5 Alpha BASIC programs and 5 assembly language subroutines, each with source code, object code and documentation. The package runs on Alpha Micro computers.

Utilities include:

RENUMB — Renumbers and denumbers BASIC programs. Useful also to put numbers on statements entered without numbers.

XREF — Generates cross reference listing of BASIC programs. Processes about 10 blocks of source code per minute.

RANCPY — Copies "N" blocks of a random file to a second file. Useful for hard disk to floppy disk transfer of large files.

HEAD — Enables characters typed on the CRT to be printed on the printer. Useful if your printer has no keyboard. in the appropriate LF and CR.

Subroutines are:

XFERBY — Designed to do byte transfers of string variables, to get around Alpha BASIC's habit of padding spaces to the left of an unformatted string transfer.

XSHELL — A flexible subroutine to sort arrays in BASIC programs.

XCMAND — Reports if any command file is active, useful for knowing if input will be from a command file or from the user.

XSCRAN — Scans a string for symbols; used in the XREF program.

XTREES — Binary tree search for the XREF program.

Price for the package is $35 for the floppy disk and $125 for the HAWK cartridge version. Price includes source and object programs plus documentaiton for each utility. For more information contact The Real Oregon Computer Company, 207 West 10th Avenue, Eugene, OR 97401; (503) 484-1040. *Circle No. 150*

Invoicing System for TRS-80

An Invoicing System for the TRS-80, designed to interface directly with the Osborne & Associates Accounts Receivable System, is now available from Taranto and Associates.

The Invoicing System provides the ability to enter sales items in the computer, picking up the customer name and address from the A/R System file, computing sales taxes and printing the invoice on one of two available pre-printed forms. Completed invoice transactions are automatically transferred to the Accounts Receivable System for accounting and full reporting functions of that system.

The system is available for $99.95. A fifty page documentation book is priced separately at $10. The Accounts Receivable System is needed to use the Invoicing System.

For more information contact Taranto & Associates, P.O. Box 6073, 4136 Redwood Hwy, San Rafael, CA 94903; (415) 472-1415. *Circle No. 131*

Debugging Tool for Large Programs

North Star BASIC users now get a new, inexpensive tool for modifying and debugging large programs. Total Cross-Reference lists all references to every line number and user function as well as every variable in a source program. Price is $15 including disk. A free manual will be sent on request. Contact Modern Resources, 2690 Gilham Road P2, Eugene, OR 97401; (503) 687-0181. *Circle 132*

Financial Package for Small Business

A financial package for small to medium sized businesses, designed for North Star-based microcomputer systems, has been released by MicroSource.

Requiring no previous programming or computer experience, MoneyBelt-The Money Manager consists of five modules incorporating General Ledger, Accounts Receivable, Accounts Payable, Payroll and Inventory Control application.

MoneyBelt operates automatically by function selection, eliminating the need to run or load specific programs. Accounts or records on file can be added, changed or deleted with single transactions, and screen selections are available for "most-used" operations. Users are guided through each step with screen commands and self-explanatory error messages, the company said. MoneyBelt is available through computer stores at $495 per module.

For more information contact MicroSource, 1425 West 12th Place, Tempe, AZ 85281; *Circle No. 133*

Microcomputer BASIC Compiler

A microcomputer BASIC compiler for 8080 and Z80 CP/M systems is now available from Microsoft. The compiler supports all the extensive, commercial features of Microsoft BASIC-80, said the company. The optimized, relocatable machine code produced by the BASIC compiler is in Microsoft's standard binary format; compiled BASIC programs can be loaded and linked with subroutines generated by Microsoft's Fortran-80 and Cobol-80 compilers, and Macro-80 macro assembler.

Because the code is fast, relocatable and ROMable, the compiler is an excellent development tool for microprocessor system and application software, said Microsoft. During compilation, extensive optimizations reduce the size and maximize the speed of the resulting binary code. The compiler's code generator is template driven, allowing optimal sequences to be generated for many commonly used operations. The result is a significant decrease in execution times over the BASIC-80 interpreter.

The BASIC compiler language includes: double precision trigonometric functions; full Print using for formatted output; extensive disk file capability; While/Wend and If/Then/Else conditionals; error trapping; long variable names; and a Call statement to call Fortran, Cobol or assembly language subroutines.

The BASIC compiler is supplied on a CP/M diskette with Microsoft's standard Macro-80 macro assembler and Link-80 linking loader. Single copy price is $395.

For more information contact Microsoft, 10800 NE 8th, Suite 819, Bellevue, WA 98004; (206) 455-8080.

Circle No. 134

APL for Vector Graphic Systems

APL is now available on Vector Graphic's System B microcomputer system. Features include the capability to boot directly into a program from CP/M; arrays up to eight dimensions; system variables, execute and format; dynamic execution of system commands; disk workspace and copy object library, said the company. In addition, APL requires few data declarations and permits procedure definitions to be independent of other definitions.

Also available is an APL subroutine for implementing a keyed Index Sequential Access Method (ISAM). Price is $400 including manual, diskette and character PROMs. APL keytops are optional. For more information contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361; (213) 991-2302. *Circle No. 135*

WHAT'S COMING UP

Data Base Management Software

A frequent complaint from micro-computer users is lack of adequate software. While large mainframe and minicomputer systems have available sophisticated data base management tools, microcomputers have usually been limited to some variant of an ISAM file management package. Now this is about to change. Micro Data Base Systems, Inc., is offering a sophisticated network DBMS for microcomputers.

To obtain maximum efficiency, the software is written in machine language and is initially available for the Z-80 CPU. The software for other major CPU chips will be released in the near future. MDBS provides a full network capability and even generalizes some features of the Codasyl approach. For example, instead of restricting a set relationship to be one to many, MDBS permits many to many set relationships. A record type can be both the owner and member of a set relationship. Full data base security is maintained by providing read and write access levels for all record types, items and set relationships.

MDBS officials point out that using data base software to produce applications systems cuts development time significantly. Flexibility is a further benefit. In the case where new reports are needed, instead of having to do extensive recording, usually only a small data extraction module is necessary. Maintaining a common data base has the advantage that no data need be duplicated in different files and that different applications can be supported in the one data base.

For easy usage DBMS routines are callable from host languages (such as BASIC Pascal) and have I/O and host language interface routines isolated for easy adaption to user host language/operating system combinations. Interfaces are available for North Star, CP/M and TRS-80 operating systems.

MDBS offers an introductory price of $750, including the Data Definition Language Analyzer/Editor, Data Manipulation Language, 200-page user's manual and sample application programs.

For more information contact Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902; (317) 742-7388.
Circle No. 104

TRS-80 Software

New programs are available from Radio Shack stores, dealers and computer centers.

General Ledger I ($99.95, diskette only) is an accounting system designed specifically to post and maintain the general ledger of a small business. Disk Mailing List System ($39.95) for mini-disk owners, builds and maintains a list of names. Cassette Mailing List System ($19.95) is a RAM-based Level-II program for non-disk users.

An Inventory Control System (ICS), on diskette only, provides the user with the information needed for proper control of a retail inventory. Price is $99.95.

Statistical Analysis (Level I only) is designed for routine data analysis in business, education, medicine, government administration and many other fields. Price is $29.95.

Double-Precision Subroutine (Level II only) lets you obtain 15-digit accuracy with sine, cosine, arctangent, natural

logarithm, exponential and square root functions. Price is $9.95.

Advanced Statistical Analysis for Level II is a user-oriented data analysis system suited for applications in many fields. The programs can be run with little formal knowledge of data analysis techniques and no knowledge of computer programming, said Radio Shack. Price is $39.95.

RS232C Communication Software (Level II), used with a telephone interface, permits TRS-80-to-TRS-80 communications by telephone. This program alows you to send business data to a branch office across the country, or simply send a program to a friend across town. Price is $29.95.

Real Estate, in volumes 1,2 and 3 (Level-II), provides computerized analysis of mortgage data, interest, resale analysis, income and expense projection and more. Price is $29.95 per volume.

Among the educational programs now available for the TRS-80 in Level-I are: Level I BASIC Course, a program that teaches you how to program; Math 1, designed to aid in learning basic math operations; and Algebra 1, designed to teach the basics in algebra. price is $12.95.

Level II BASIC Course in two parts is also offered. Part One ($14.95) introduces the Level-II language's primary commands. Part Two ($19.95) takes you through the more complex capabilities of Level-II.

Several advanced programming aids include: Editor/Assembler, which permits assembly language programming with the speed and efficiency of machine language combined with the convenience of a text editor and assembler, ($29.95). T-Bug System Monitor, a powerful, machine-language monitor designed to provide direct access to the Z-80 CPU ($14.95); and Level II Line Renumber ($9.95).

Micro Music turns your TRS-80 (connected to an amplifier and speaker) into a musical instrument that even someone with no musical talent can play. Price is $9.95.

Micro Movie lets you create moving pictures on the TRS-80's video screen by drawing "scenes" within the limits of standard TRS-80 graphics, creating movement, repeating previous scenes and creating other effects to make your movies seem more realistic. Price is $9.95.

Micro Marquee will produce a moving sign containing 13 one-inch characters per line. Price is $4.95.

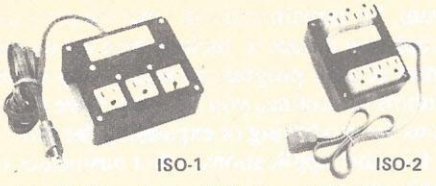
Prices listed are suggested retail price and may vary at individual stores and dealers.

For further information contact Radio Shack Computer Customer Service, 205 NW 7th Street, Fort Worth, TX 76106. *Circle No. 105*

Operating Systems for 8080 and Z-80

Digital Research, originator of the popular CP/M operating system, announced two new operating systems: CP/M 2.0 and MP/M. Both are adaptable to nearly any 8080 or Z-80 computer system with disk backup storage.

CP/M 2.0 is an enhanced version of CP/M release 1, and maintains upward compatibility. The expanded file system covers a wide range of disk capacities, from simple minidisks up through large capacity hard disk drives. Configuration is



WANTED: BUSINESS PROGRAMS

Personal Computing readers want your business applications programs. Chances are, the software you've developed to solve your business problems will also help someone else faced with a similar problem.

Consider how your business benefits from your microcomputer — not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, materials handling, product design and cost accounting are areas ripe for creative programming. Readers want help with all of these problems.

So why not share your solutions with our readers? Send us an article describing the problem you faced and how you used your microcomputer to solve it. Be sure to include a program description, program listing and sample run.

Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

All submissions should be original, typed (not all CAPS), double-spaced and neat. Include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material. Also, please use a fresh ribbon on your printer for program listings and sample runs.

Feel free to call us at (617) 232-5470 if you have any questions or want to discuss specific article ideas.

Mail your manuscript to:

Editor
Personal Computing
1050 Commonwealth Ave.
Boston, MA 02215

accomplished through a disk definition table which drives the file management algorithms, thus allowing simple field alteration. Standard operating system utilities are supplied with CP/M 2.0, with a number of application packages, language processors and development systems available from independent software suppliers.

MP/M, a CP/M-compatible multiterminal operating system, supports real-time multiprogramming at each teminal, along with background and foreground modes. MP/M can serve as a complete program development environment for one or more users, or as the nucleus of clustered terminals or processors accessing a common data base. MP/M device drivers can be altered in the field to operate with interrupt-driven or polled I/O devices. An interactive system generation procedure simplifies construction of particular MP/M configurations. MP/M operates currently with 8080 or Z-80 microprocessors and will be available for the more powerful 8086 processor in the future.

Single copy prices are $150 for CP/M 2.0 and $300 for MP/M, which includes documentation and diskette in single density 8" form. For more information contact Digital Research, Box 579, Pacific Grove, CA 93950; (408) 649-3896.
Circle No. 106

Business Software

Structured Systems Group has enhanced its General Ledger accounting package with the SCFP Statement of Changes in Financial Position module. SSG has also released Letteright, a software package for handling typical office correspondence needs.

The financial module is available as an update to registered owners of the General Ledger, and is shipped (at no extra charge) as part of the General Ledger System.

Two statements are automatically produced by the module: the Sources and Uses of Working Capital statement and the Changes in Components of Working Capital statement. The subsystem, selected from the operator menu, is designed to require no operator input at statement time.

Provisions are included to break out and label unusual transactions, as specified by the user. Set-up requires only entry of non-cash expense accounts and their related contra-asset accounts (for example, depreciation expense and accumulated depreciation).

Accompanying this SCFP module on currently released SSG General Ledger packages is a new operator menu. The Ledger runs on CP/M based microcomputer systems with dual floppy disks. It is available through computer retailers, including ComputerLand.

The Letteright system will read names and addresses from any SSG NAD Name and Address file, writing those names and addresses in the document where specified, and on the envelope, for easy mass mailings.

Substitution values allow the user to create form letters or other standard documents; the text is closed in around the substitution value automatically. A typical application would be to answer routine requests, according to SSG. The user calls up the document, keys in the substitution values for the individual inquiry, and prints the letter.

Letteright is fully menu driven and documented in a 53-page user's manual. The user can choose a "fast path" to generate a single document, or add to the "Document Catalogue" of documents ready for modification and re-use stored on floppy disk.

Paragraph indentations and line width are easily set or changed. The screen-oriented entry module features backspace, cursor up and down, erase a character or line of text, scroll up or down, and move-line/move-block capabilities.

Letteright requires a CP/M based microcomputer with 48K RAM, at least one disk drive, a printer that can skip to top of form and an 80×24 CRT with cursor addressing. The package is available through computer retailers, including ComputerLand.

For more information contact Structured Systems Group, 5204 Claremont Avenue, Oakland, CA 94618. *Circle No. 107*

Apple II Development Software

A new aid to the development and documentation of Applesoft programs includes a set of 3 programs.

Vardoc produces a list of every variable used in a program and all the lines each is used on. Screen and/or printer output can include optional descriptors of each variable. The program occupies 3.5 to 5.8K of memory depending on options.

Linedoc produces a list of every line called by a GOTO, GOSUB, etc., and all the lines each is called from. The user is also alerted to calls to lines no longer in the listing. Memory occupied is 3.5 to 5.8K depending on options.

Replace allows the user to easily rename any or all occurrances of a variable, or replace constants or referenced line numbers throughout a listing. Literal Mode allows the replacement of any set of characters or BASIC statements with any other set.

Price is $9.95 for cassette, $13.95 for diskette (California residents add 6%). This software is available from local computer stores or Southwester Data Systems. For more information contact Southwestern Data Systems, P.O. Box 582, Santee, CA 92071. *Circle No. 108*

Digitizer Demo Software

A demonstration disk which fully integrates Houston Instrument's Hi-Pad Digitizer with any North Star-based computer and Vector Graphic's High Resolution Video Display, is available from MicroAge Wholesale.

The Hi-Pad Digitizer allows graphics input on a microcomputer with both serial and parallel interfaces as standard features. Resolution by inch and metric measurement is included on the Hi-Pad. The digitizer also has a translucent tablet area for rear projection. Applications include medicine, architecture, engineering, graphic arts and cartography. These application are explained on the demo disk.

Price for the demonstration disk is $35; $795 for the Hi-Pad Digitizer. For more information contact MicroAge Wholesale, 1425 West 12th Place, Tempe, AZ 85281; (602) 894-9247. *Circle No. 109*

Educational Software for Pet

Program Design has announced new titles in their series of educational software for the PET.

"Reading Comprehension: What's Different?", a set of 10 Pet programs, presents logical problems in which the student picks the one word in four that doesn't belong. A sample problem is "red, blue, clear, green", where "clear" is not a color. Words are picked from words lists for second to sixth grade. The game builds analytical skills necessary for reading comprehension, the company said.

"Word Skills 1—Prefixes", for the PET, is the first of a series of courses from the Brain Box educational software house to be published by Program Design. It is an entertaining and lively presentation of some common prefixes and the words they appear in, said the company. The course helps kids 10 and up improve their vocabulary and reading skills.

All courses plus PDI's other titles are available from computer stores or directly from Program Design. For more information contact PDI at 11 Idar Court, Greenwich, CT 06830; (203) 661-8799. *Circle No. 127*

Business Packages for TRS-80

Applied Economic Analysis has released a Quarterly Macro-economic Simulation Model of the U.S. Economy for the TRS-80, along with a business planning package and a Box-Jenkins forecasting model.

The model was developed for use by those whose business operations are affected by government policy actions. The user manual explains how the model works and offers guidelines for constructing "easy money" or "fiscally tight" economic policies.

With this model, you can check the government's projections on inflation, interest rates and over eight other economic variables. By tying this model into a company financial simulation model, a complete business planning system can be developed.

The U.S. Simulation Model comes with two disks (one for the model and the other with over 40 of the most widely used economic data series), a three-ring binder containing the user's manual and the documentation and a complete simulation run of the U.S economy for the next six quarters. The complete system is $179.

The disk based planning package for the TRS-80 aids the user in projecting sales, inflation and stock prices.

Included in the package is a short term forecasting program which utilizes both exponential smoothing and the forecasting method of adaptive filtering. A comprehensive, advanced version of multiple regression which contains

many user conveniences along with a flexible graphing program is also integrated into the package. The data management program allows the user to create, modify and add to any disk based data set created under this package.

A User Manual contains over 100 pages of instructions and examples of successful forecasting techniques. A second disk in the package contains over 30 of the most widely used economic data series. This data set is accessible by all programs. Package price is $97.

Box-Jenkins, a widely used forecasting method, can now be implemented on TRS-80s with disk capabilities and at least 32K of memory.

This technique is used for sales, price, interest rate and production forecasting. Most Box-Jenkins models require a significant amount of user interpretation to determine the best set of parameters, said the company. The current model gives the user the option of letting the computer select the best set of parameters to be used for forecasting. In this way even those who are unfamiliar with the Box-Jenkins procedure can use the technique.

The $97 package comes in a three ring binder with diskette and over 40 pages of explanation and documentation.

For more information contact Applied Economic Analysis, 4005 Locust Ave., Long Beach, CA 90897; (213) 424-3652. *Circle No. 128*

New Software for Pet

National Artificial Intelligence Laboratory has available two new machine language programs for the new 32K and 16K Pet computers, or older 16K and 32K machines with new ROMs. SYS32000 and SYS16000 are for use on the 32K and 16K machines, respectively.

The programs provide nineteen functions including: standard and custom renumbering including all internal reference line numbers; compact, which removes all unnecessary spaces from a BASIC program with the exception of text and data statements; trace, which shows line numbers as BASIC program is executed; append and merge one or more BASIC programs to another; and additional disk and tape related functions.

All functions are contained in a single machine language program which, once loaded from tape or disk, remains resident and undisturbed in the machine's memory until power down. Space usage is under 4K. The programs are available on tape or disk for $100, or on a ROM which plugs into one of Pet's expansion sockets with no wiring or alteration of the machine, for $200.

For more information contact National Artificial Intelligence Laboratory, P.O. Box F, Mobile, AL 36601;(205) 433-5529. *Circle No. 129*

Disk Utility Pack for Apple

Apple Computer announced the Disk Utility Pack — a collection of system software routines for disk-based Apple II computers. Programs include:

- DOS 3.2, the latest version of the Apple II Disk Operating System
- Update, which upgrades the existing DOS on any diskette to the 3.2 version without disturbing other programs
- Applesoft Chain, which allows one extended BASIC program to run a second without losing data defined by the first
- Renumber/Merge, which renumbers and combines several extended BASIC routines into a single program

Disk Utility Pack comes complete with System Master Diskette (containing the new programs), a blank diskette and the DOS 3.2 manual. Price is $25 from Apple dealers. Contact Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95014. *Circle No. 120*

Stock Tracker Program

Stock Tracker for TRS-80 and Apple II disk systems analyzes supply and demand factors on individual securities and generates short- and intermediate-term buy, sell and hold recommendations for stocks and options. It can also be used on commodities futures.

The system can be put to work on as few or as many securities as the user wishes, and is available in three versions. The TRS-80 single-drive version stores up to eight months of trading data on 15 stocks per data disk, and is easily user modified when the system expands to an additional drive. The multi-drive TRS-80 version handles over a year of data per Drive 1 disk. The Apple II version keeps even more data.

Stock Tracker requires a minimum of 32K RAM; a printer is recommended but optional, and the printouts can be run on any interfaced printer.

Individuals ordering the TRS-80 single-drive version must send their Radio Shack TRSDOS disk due to the TRSDOS copyright. Price for program and manual is $150; $35 for manual.

Contact H & H Trading Company, 111 Cleveland Road #20, Pleasant Hill, CA 94523; (415) 937-1030. *Circle No. 118*

Household Finance

Household Finance, a 32K disk-based Applesoft II Program, allows you to select up to 16 different categories for budget entries and give each a "+" or "−" value. You may then display the data in text or graphic form.

The $14.95 price (postpaid) includes disk and complete documentation. For more information contact Arthur Michel Software, 2131 N. Hudson Avenue, Chicago, IL 60614. *Circle No. 126*

COMPLEMENTS

Key Pad for Apple

The Key Pad, engineered for the Apple II and Apple II Plus, provides 13 keys (0 to 9, decimal point, minus sign, Enter) and is easily attached to any Apple computer, which it matches in color and form.

Arm position and fingering on the Key Pad is simplified by the low-profile design which allows either hand-held or desk-top use. The connector is molded as a single unit for durability. Suggested single unit user price is $99.

For more information contact Advanced Business Technology, Inc. (ABtech), 12333 Saratoga-Sunnyvale Road, Saratoga, CA 95070; (408) 446-2013. *Circle No. 142*

CRT Terminal Table

Facit, Inc. has introduced a split top CRT Terminal Table specifically de-

signed for use with a keyboard input and screen unit.

The split table-top allows individual height adjustments for each unit. A pneumatic cylinder on the screen surface allows for ease in adjustment: the screen tilts backward and forward for reading comfort, as well as to offset reflections on the screen. The keyboard surface adjusts horizontally and vertically.

A tubular column on a pentapod base, the table support provides ample leg room for the operator, said the company. Twin-wheeled casters allow the table to be easily moved. Designed to blend decoratively with other office furniture, the table is constructed of 13 gauge steel tubing with a one-piece cast aluminum base and oak surfaces.

For more information contact Facit, Inc., 66 Field Point Road, Greenwich, CT 06830. *Circle No. 143*

Labels for Program Cassettes

Avery Label added three self-adhesive labels to its word processing label line. The new labels allow quick location and identification of standard cassette tapes.

The 5270 title label is 3-1/2″ wide, but only 5/8″ high. This blank, white self-adhesive label lets you easily change a cassette's title. It fits just above the cassette's sprocket holes without covering the cassette manufacturer's information.

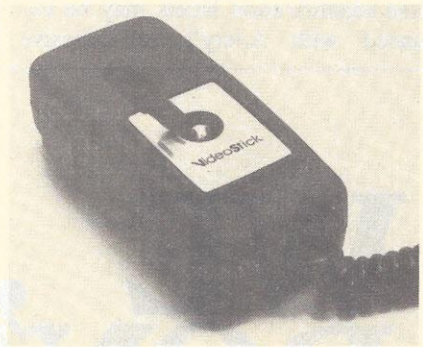
Back edge identification of cassettes is provide by Avery's blank, white 5254 spine label, 1/4″ × 2-3/4″. These labels are spaced at typewriter intervals for typing convenience.

Avery's 5255 label, 9/16″ × 4″, fits the back edge of standard cassette protective boxes. This blank, white label offers space for identification statements, codes and symbols.

To spotlight special cassettes, all three identification labels may be enhanced with Avery's self-adhesive color coding labels, available in light blue, red glow, green glow, yellow glow and orange glow.

A package of 245 of the 5270 title labels carries a suggested retail price of $1.95. The cassette spine label, #5254, in a package of 450 is offered at the same price. The #5255 cassette box

label, packed 248 in a package, also has a suggested retail price of $1.95. Contact Avery Label, 777 E. Foothill Blvd., Azusa, CA 91702.
Circle No. 137



X-Y Controller for Apple

Videostick, an X-Y controller for the Apple II, features a large push (firing) button and a long life linear joystick designed specifically for video applications such as plotting graphics or playing games. The controller plugs directly into the Apple II and can be hand held or table positioned.

Priced at $39.95, the Videostick is available from stock and distributed by Computer Plus, Inc., 1324 South Mary, Sunnyvale, CA 94087.
Circle No. 188

Modular Desk Units

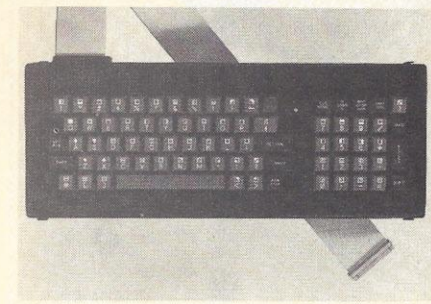
Computer Plus now offers a line of modular desks for microcomputers. All units feature a 60" × 30" desk top, 27" high, walnut formica with white accents, foot levelers, weight braces and modesty skirt. Price is $190. For more information contact Computer Plus, Inc., 15 Mare Lane, New Milford, CT, 06776; (203) 354-0617.
Circle No. 138

Combining Videotape and CAI Teaching

Computer-assisted instruction (CAI) and videotaped teaching can be combined with a new package from Cavtri Systems. The package lets you integrate CAI with complex, moving, colorful visual materials plus speech, music and sound effects. You can add CAI to any existing videotape.

A segment of videotape on a topic is presented to a student. The computer is programmed to automatically pause the videotape player after the segment is finished and to switch control of the TV screen to the computer, which generates CAI text on the materials just presented. Only after the student has shown, by responding correctly on the keyboard, that he understands the subject matter will the next segment of the videotaped instruction begin. Student responses may be scored if desired.

Cavtri's package consists of all materials needed to integrate an Apple II and any videotape player/recorder having remote pause capabilities. The package includes computer/videotape interface, wires and connectors, instruction manual and starter cassette containing a group of subroutines to assist teachers in writing CAI programs for the system. Price is $390. Contact Cavtri Systems, 26 Trumbull St., New Haven, CT 06511; (203) 562-9873.
Circle No. 139



Pet Keyboard Replacement

Century Research and Marketing has introduced a replacement keyboard for the Pet Computer. Called the Pet Tune-Up Kit, this new keyboard is a full-size computer terminal style unit with standard double-shot molded keytops. All of the Pet graphic legends are provided, on both the main keyboard and a numeric keypad. A replacement cable and connector are provided, allowing the user to install the keyboard without wiring or computer modifications.

The new keyboard includes extra Return, Space, Shift and Print Statement keys on the numeric pad so that an operator can execute program steps without moving back and forth from the keyboard and numeric pad. An extra function key is provided for whatever functions the user chooses, such as a

hardwired system Reset key. A snap-off keytop cap enable the user to place a typewritten legend on the keytop.

The kit is built with a rigid steel plate which supports the switches, and a computer-grade circuit board. Switches have long-life gold plated mechanical contacts rated at over 10 million cycles.

Cost is $109.95, including shipping. The molded plastic enclosure is available for $24.95. For more information contact Century Research and Marketing, 4815 W. 77th St., Minneapolis, MN 55435. *Circle No. 140*

Extended Warranty for Apple Computers

Apple Computer's new one-year extended warranty may be purchased by Apple customers at any Apple authorized Level I service centers. Priced at $195, the warranty features same-day turnaround for carry-in repairs at Level I centers. The extension covers all systems and products manufactured by Apple. Any additions made by a customer to base system during the warranty period are also covered by the program at no additional cost.

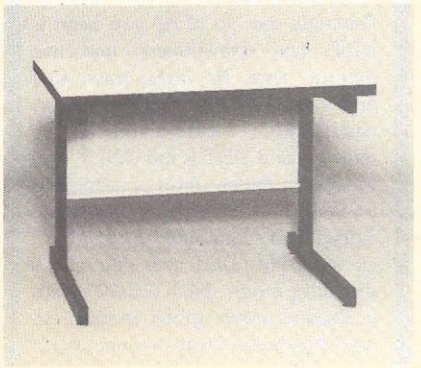
Other features include:

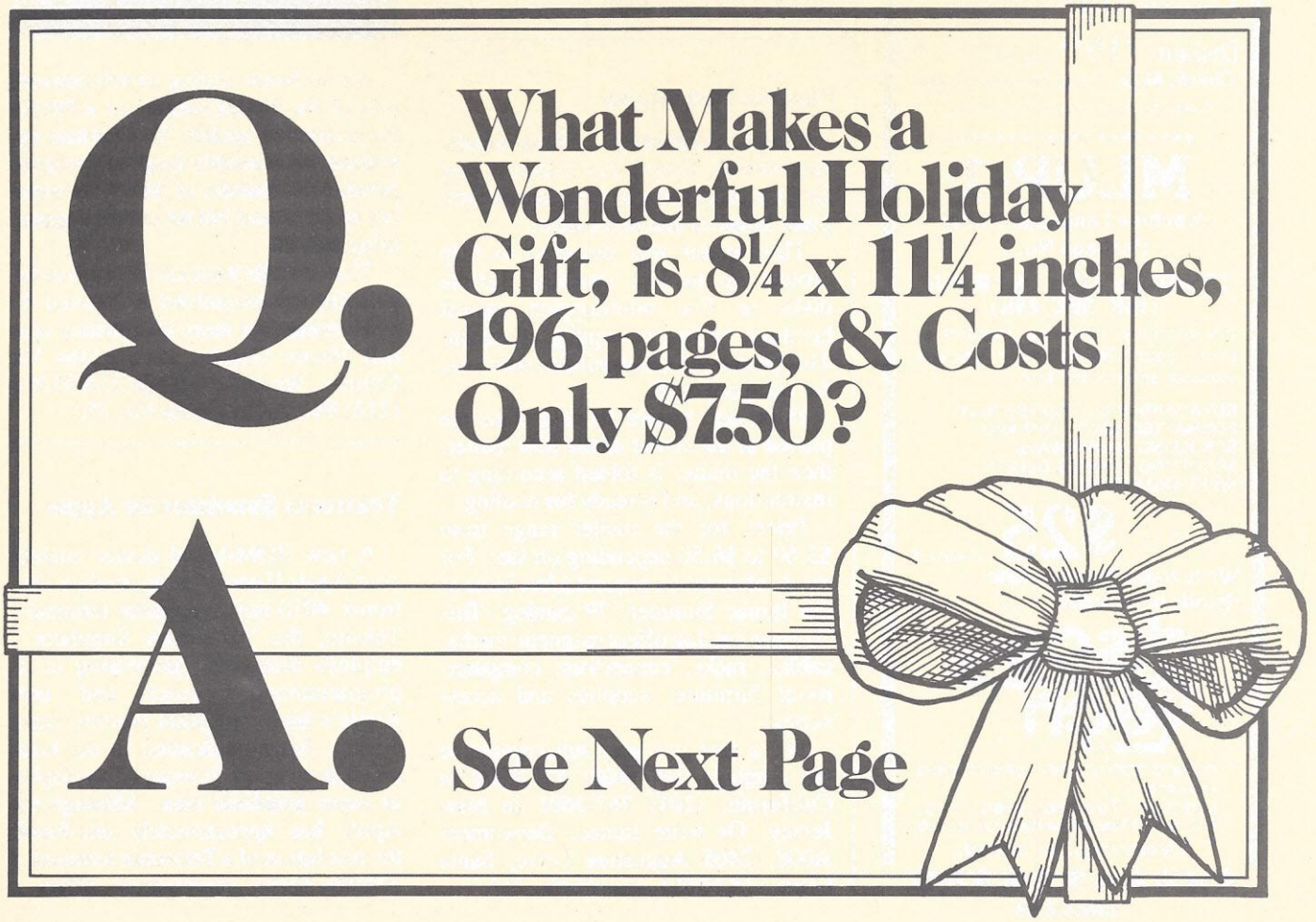
- Fixed cost of ownership. The program establishes maintenance as a fixed cost, letting a business budget for service at a predefined rate.
- Minimal equipment downtime. The program reduces repair turnaround time because of the diagnostic and board replacement system which allows while-you-wait service at Apple Level I service centers.
- Warranty renewability. The warranty may be renewed in annual increments.

The warranty may be purchased during the normal 90-day parts-and-labor warranty period. Apple Computer's address is 10260 Bandley Drive, Cupertino, CA 95014; (408) 996-1010. *Circle No. 130*

Terminal Stands

Computer Furniture and Accessories offers a line of terminal stands available in different sizes, heights and colors. Options include stepped returns, 2 or 3 drawer pedestals, storage cubes, casters, cable cutouts with cable ducts, and chrome legs. Units are available in one to two weeks. Contact Computer Furniture and Accessories, Inc., 1441 West 132nd St., Gardena, CA 90249; (213) 327-7710. *Circle No. 141*





Computer Desk for Hobbyists

Systems Furniture Company has introduced a new work station for serious hobbyists.

Designated "Specialty 5", the new series has a contemporary cantilevered style, welded tubular steel legs, stain and scratch resistant high-pressure laminates and textured, baked enamel finish. Two models feature an auxiliary shelf eight inches above the desk surface for placement of accessories peripherals, CRTs or manuals. This comfort edge included on all Specialty 5 models.

Prices for the work stations vary from $165 to $200 in quantity one.

Shipment is from stock, in either of two color combinations: Off-white top with walnut comfort edge, black legs and black modesty panel or teak top with brown comfort edge, brown legs and champagne modesty panel

For more information contact Systems Furniture Company, 13900 South Figueroa Street, Los Angeles, CA 90061; (213) 327-4000. *Circle No. 144*

Flexible Disk Mailer

Inmac (formerly Minicomputer Accessories Corp.) has added a new flexible disk mailer to their line of computer supplies and accessories.

This mailer was designed to help protect up to five standard flexible disks or five minifloppies against bending, curling or cupping in transit. This protection can minimize data loss, the company said.

From one to five flexible disks are placed in the center of the new mailer, then the mailer is folded according to instructions, and is ready for mailing.

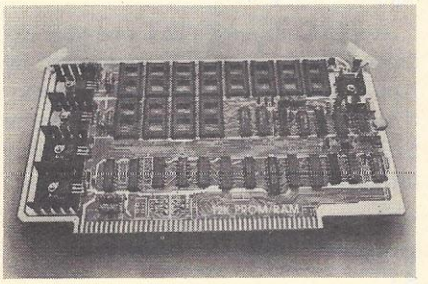
Prices for the mailer range from $3.60 to $6.50 depending on size. For more information request a free issue of the Inmac Summer '79 catalog. This 70-page catalog offers magnetic media, cables, racks, connectors, computer-room furniture, supplies and accessories.

For a free one-year subscription to the catalog, call (408) 737-8700 in California, (201) 767-3601 in New Jersey. Or write Inmac, Department A008, 2465 Augustine Drive, Santa Clara, CA 95051. *Circle No. 151*

P.C. BOARDS

PROM/RAM Board Doubles as PROM Programmer

Vector Graphic's S-100 bus PROM/RAM board features a PROM programming capability for creating customized software. The new board accommodates up to 12K of 2708 or 2704-type programmable read-only memory with 1K of 2114 static RAM. Addressing is controlled by jumper options and special circuitry is incorporated for the reset-and-go function and to generate MWRITE.



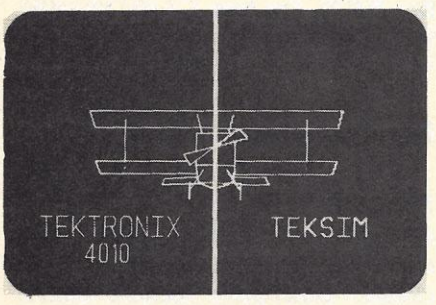
An on-board sliding switch converts one of the PROM sockets to a PROM-programming socket. To facilitate operation, an assembly language program permits the transfer of data from memory to an erased PROM in the programming socket.

The 12K PROM/RAM Board is available factory assembled and tested for $215 retail. For more information contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361; (213) 991-2302. *Circle No. 152*

Tektronix Simulator for Apple

A new ROM-based device enables your Apple II computer to emulate Tektronix 4010-series graphics terminals. Teksim, the "Tektronix Simulator", employs distributed processing in its programming approach and uses Apple's high resolution plotting capabilities. No modification to the host-resident program is required to display or input graphical data. Although the Apple has approximately one-fourth the resolution of a Tektronix terminal, a Teksim-Apple combination offers a

substantial cost advantage plus features such as multi-colored displays, selectable erase and standard video output that lets any TV set function as a monitor. Suggested retail price is $795 from Cybersoft Systems, 301 S. Livernois, Rochester, MI 48063; (313) 652-9008. *Circle No. 153*



Eliminating Data Read Errors

Percom Data Company offers a plug-in adapter for the TRS-80 and Southwest Technical Products' MP-F mini-disk controllers. The device helps eliminate data read errors caused when clock and data bits are not reliably separated during playback.

Called the Separator, the adapter may be installed without making any changes to the host system. The user removes the 1771 disk controller IC from the host controller, installs the IC in the DIP socket on the Separator card and then plugs the card into the vacated 1771 disk controller IC from the host controller, installs the IC in the DIP socket on the Separator card and then plugs the card into the vacated 1771 socket of the host system.

According to Percom, the problem of unreliable data separation arises from the internal data separation circuit of the 1771 IC. The Separator uses an external data separation circuit featuring special circuitry to compensate for bit shifting, which arises during playback of high density data.

Assembled and tested, Separator sells for $29.95, including installation instructions. Orders may be placed by calling Percom toll-free at 1-800-527-1592, and may be paid by check, money order, COD, Visa or Master Charge. Texas residents must add 5% sales tax.

For more information contact Percom Data Company, Inc., 211 N. Kirby, Garland, TX 75042; (214) 272-3421. *Circle No. 154*

LITERATURE

Catalog of Computers and Peripherals

The 1979 edition of Advanced Computer Products' catalog, now available, is a reference guide for users of both large and small computers and peripherals. Featured is a new section of "Intelligent Computer Products and Gadgets." Products offered include: personal computers, business comput-

ers, software, floppy disks, media, ICs, calculators, books, translators, hand-held games and backgammon, chess and car computers. The 92-page catalog is available for $1. Contact Advanced Computer Products, 1310 E. Edinger, Santa Ana, CA 92705; (714) 558-8813. *Circle No. 157*

TRS-80 Software Catalog

National Software Marketing's new 14-page catalog of software for Radio Shack computers includes programs for payroll, accounts receivable, inventory, sales analysis, real estate management, project management, finance, statistics, tutorials and games. The catalog also describes Super Disk and Super Tape, a program library of over 70 programs for $13.95. For a free copy of the catalog write National Software Marketing, Inc., 4701 McKinley St., Hollywood, FL 33021. *Circle No. 160*

Educational Software Catalog

A new mail order catalog devoted to educational software for personal computers contains listings from numerous publishers separated by educational level and field, and by computer. All software can be ordered directy from Queue. For more information, contact Queue, 5 Chapel Hill Drive, Fairfield, CT 06432, (203) 372-6761. *Circle No. 158*

Printwheel and Ribbon Brochure

Qume Corporation offers a brochure describing the company's selection of printwheels and ribbon cartridge products for use with its daisywheel character printers.

The 14-page brochure contains brief descriptions, comments on typical applications and examples of both typestyles and colors for Qume's plastic printwheel and fabric, multistrike and singlestrike ribbons. Included in the brochure are tables listing, in sequenctial part number order, all of Qume's 82 printwheels, with language, typestyle, pitch and character set information shown.

For more information contact Qume Corporation, 2350 Qume Drive, P.O. Box 50039, San Jose, CA 95150; (408) 942-4000. *Circle No. 159*

Microcomputer Products

A new catalog from Electronic Specialists presents their line of microcomputer interference control products. Protective devices are also included. Descriptive sections outline particular problems, and provide possible solutions. Typical applications and uses are also outlined. For more information contact Electronic Specialists, Inc., 171 South Main St., Natick, MA 01760; (617) 655-1532. *Circle No. 156*

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These programs, collected from two years of *Personal Computing* magazine, will run on most popular microcomputer systems.

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Some of the other programs well received over the last two years and reprinted here include: Investment Analysis to help decide highest profit potential, Contract Labor Cost Accounting, Calculation of Seasonal Indices, Computerized Phone Directory, Use of Sensing and Control Devices in the Automated House, Personal Budget Control and Automatic Data and Appointment Reminder.

Programming students will find the program listings (mostly in popular BASIC programming language) an important aid to understanding and learning more about practical computer programming.

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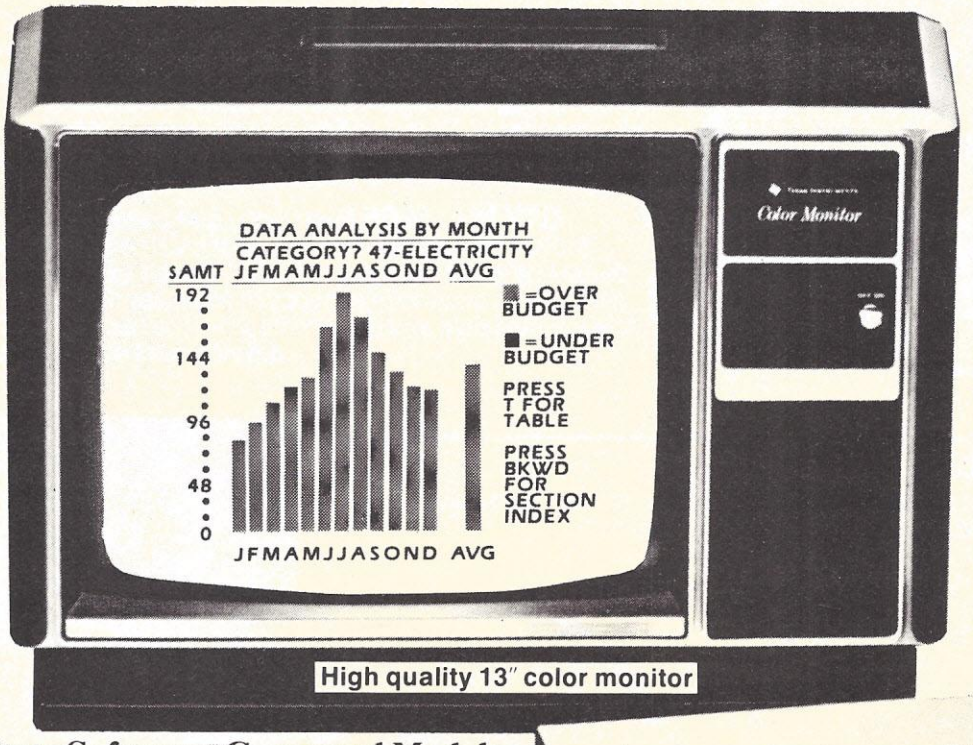

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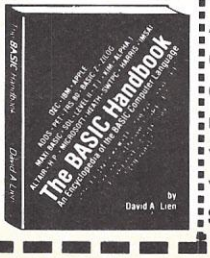

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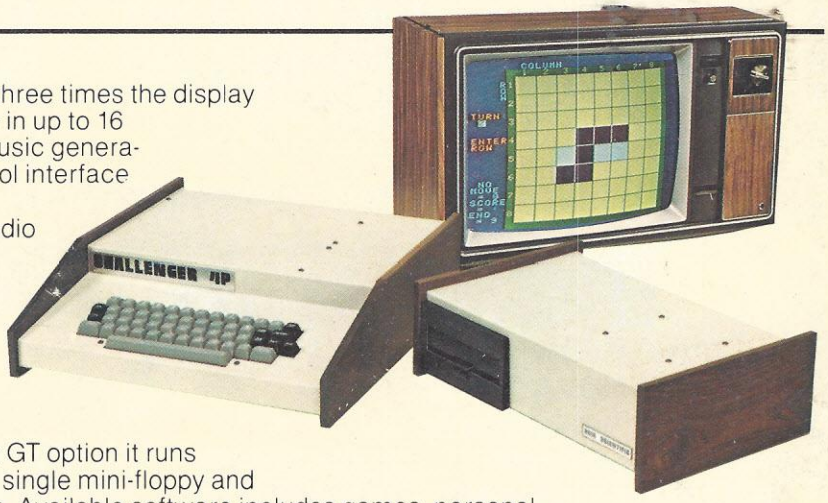

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*Monitors and cassette recorders not included. Ohio Scientific offers a combination TV/Monitor (AC-3P) for $115.

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